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ELECTRICAL ENGINEERING ABSTRACTS

Published by The Institution of Electrical Engineers

Electrical Engineering Abstracts

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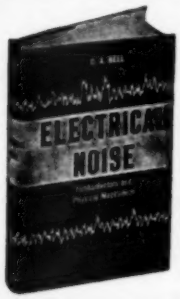

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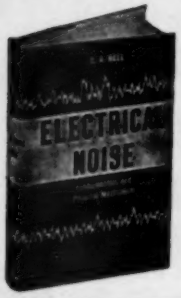

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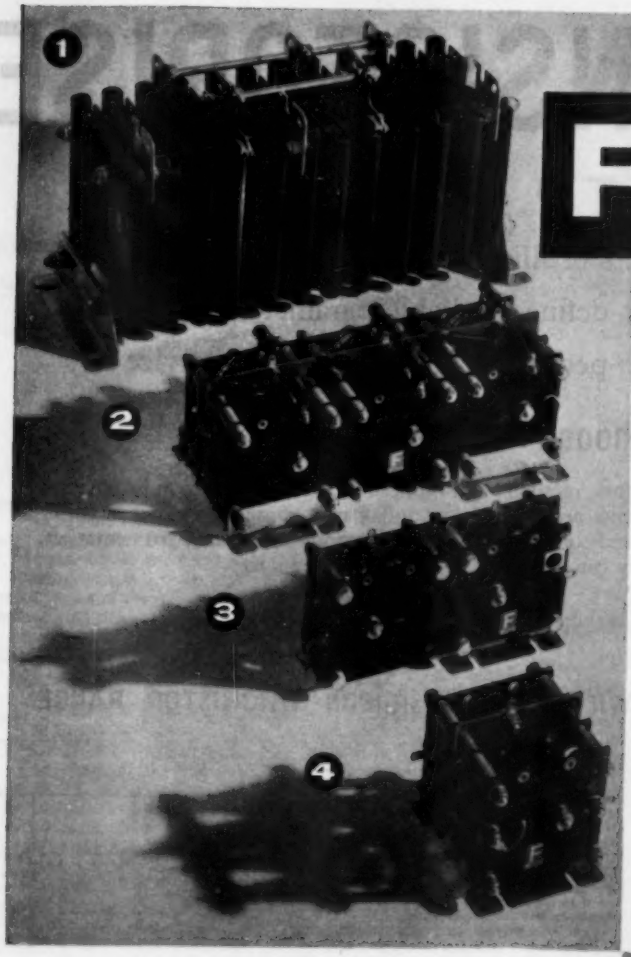

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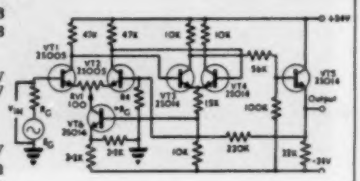

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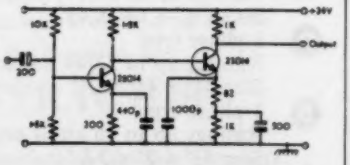

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ELECTRICAL ENGINEERING ABSTRACTS

Volume 63 **FEBRUARY 1960** **Number 746**

GENERAL

(For abstracts on circuit theory see also Lines . Networks . Filters)

614.844 : 621.314.2

619 EXTINCTION OF RUNNING OIL FIRES. USE OF WATER SPRAYS. D.J.Rasbash and G.W.V.Stark.
Engineer, Vol. 208, 862-4 (Dec. 25, 1959).

A summary is given of tests on the control and extinction by water sprays of fires involving oil pouring over vertical and horizontal banks of steel tubes. The object of the work was to find how spray properties and fire properties influence extinction and to obtain some quantitative information on which the design of protective installations could be based.

621.3.01

620 THE USE OF ITERATED LAPLACE TRANSFORMATIONS IN THE SOLUTION OF COMBINED CIRCUIT-FIELD PROBLEMS. J.H.Mulligan, Jr.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 506-11 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

By consideration of a detailed example, the use of iterated Laplace transformations is shown to be an important technique for the solution of combined circuit-field problems, i.e., problems in which the simultaneous solution of ordinary and partial differential equations is necessary. One- and 2-mesh circuits in which eddy currents in a rectangular magnetic core play a significant role are analysed utilizing the iterated transformations; equivalent circuits characterizing the effect of the eddy currents are also presented.

621.3.011.1 : 621.374.32

621 NEW METHODS OF SIMPLIFYING BOOLEAN FUNCTIONS. R.L.Howard.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 134-43 (1959) = Applic. and Industr., No. 43 (July, 1959).

A tabular algorithm is presented by which a Boolean function may be converted to a sum of products or a product of sums, and redundant terms removed. Examples are used to illustrate the method. G.A.Montgomerie

621.3.011.2

622 VOLTAGES AND CURRENTS IN A RESISTIVE NETWORK CONTAINING A SINGLE GENERATOR. E.Bottani and R.Sartori.
Atti Accad. Sci. Torino I, Vol. 93, No. 2, 498-505 (1958-59). In Italian.

Generalized theorems of network analysis are presented to demonstrate that in a resistive circuit containing a single generator the highest values of voltage and current will be those measured at the generator terminals. M.Rathbone

621.3.012.8 : 537.3

623 CONDUCTING ANALOGS OF A MAGNETIC FIELD. J.R.Barker.
Amer. J. Phys., Vol. 28, No. 2, 139-44 (Feb., 1960).

The distribution of electric current in a conducting medium has a close analogy with the distribution of magnetic flux in a geometrically similar magnetic field. There is a second form of the analogy, when the field is two-dimensional, in which the electric equipotentials correspond with the magnetic flux lines.

621.3.012.8

624 LAWS AND METHOD OF THE TRANSFIGURATION OF ELECTRIC CIRCUITS. S.Christov.
Elektrotech. Obzor, Vol.48, No. 9, 463-8 (1959). In Czech.

Develops a universal method for the transformation of circuits into dual, similar, equivalent, or coordinated circuits. For this purpose a parameter of transfiguration and a similarity factor are introduced. Calculated examples illustrate the method. N.Klein

621.3.013 : 538.56

625 DERIVATION OF THE SPEED OF ELECTROMAGNETIC WAVES IN TERMS OF DIELECTRIC CONSTANT, MAGNETIC PERMEABILITY, AND RATIO OF CHARGE UNITS. F.G.Werner and D.R.Brill.
Amer. J. Phys., Vol. 28, No. 2, 126-8 (Feb., 1960).

An elementary derivation of the expression for the propagation speed of a change in the electromagnetic field in terms of the dielectric constant, the magnetic permeability, and the ratio of magnetic to static units of charge is given. The only knowledge of electrodynamics required is familiarity with the expressions for the electrostatic charge on a parallel plate condenser, the magnetic field in a long solenoid, and the induced e.m.f. in a loop. Also easily found are expressions for the characteristic impedance of the medium (or the vacuum) and displacement current. These are introduced in a rather directly conceivable physical manner. No use is made of calculus or vector analysis proper. No swiftly moving bodies are considered. Units are kept general so that reduction to any particular unit system is easy.

621.3.014.31 : 621.9.018.15

626 SOME PROBLEMS OF A SATISFACTORY THEORY OF ELECTRICAL EROSION IN PULSE DISCHARGES IN LIQUID DIELECTRIC MEDIA. B.N.Zolotykh.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1330-4 (Aug., 1959). In Russian.

Suggests a theoretical approach to erosion in the spark processing of metals based on the one-dimensional solution of Stefan's problem, and compares experimental and theoretical curves of amount of erosion as a function of pulse length or energy.
D.E.Brown

POWER RESOURCES
PRIME MOVERS

621.221.4

627 THE FUTURE OF PUMPED STORAGE. C.Jaeger.
Elect. Rev., Vol. 165, No. 20, 918-23 (Dec. 25, 1959).

Methods of determining the economic proportion of new pumped storage capacity to be integrated in existing systems, with particular reference to system load factor, are described and this survey is followed by general descriptions of typical schemes and a short review of modern turbines and pumps for such purposes.

POWER SUPPLY
POWER STATIONS

621.311

628 ELECTRIC POWER GENERATED BY THERMAL POWER STATIONS.

Tekn. T., Vol. 89, No. 39, 1055-6 (Oct. 23, 1959). In Swedish.

Electricity generated in 1958 is tabulated according to source of power for 13 European countries and the U.S.A. showing that in Norway and Sweden only 0.8 and 1.0% respectively of the electrical energy was derived from thermal power stations compared with 47.8% for France and 97.5% for Great Britain. Curves are also given to show the gradual rise in thermal power station efficiency in 6 countries from 22.28% in 1954 to 26-30% in 1958. G.N.J.Beck

621.311.153 : 681.142

A SOLID STATE DIGITAL COMPUTING SYSTEM FOR ELECTRICAL LOAD MONITORING. See Abstr. 1093

621.311.1

629 STATISTICAL SURVEY OF ELECTRICAL INSTALLATION IN FINLAND IN 1958. V.Pulkkinen.

Kraft o. Ljus, Vol. 32, No. 10, 219-25 (Oct., 1959). In Swedish.

New hydro-electric stations which began service during the year are listed. The total available capacity was 2200 MW, 1340 MW of it hydro-power and 845 MW steam. Data on the h.v. transmission lines in use are tabulated, the length of 110 kV lines rose by 100 km to 4266 km, but there were no extensions to the 400 and 220 kV systems. The loads due to domestic, public service and industrial consumers are shown; the total consumption was 79580 GWh. Steam-generated power (condensation and back pressure) is calculated against amount, costs, and type of fuel whether wood, sawdust, coal or peat, and showing the corresponding figures for the 16 previous years. G.N.J.Beck

621.311.16 : 621.316.728

630 AN AUTOMATIC DISPATCHING SYSTEM. M.J.Brown.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 957-63 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

The factors involved in the design of an automatic dispatching system are discussed in detail in order to establish the background common to the dispatching operations of all electric utility systems. An automatic dispatching system based on the principles outlined is shown in block diagram form and its operation is described. The description includes an account of dispatching procedures for an operation using the system shown in the block diagrams. A description of emergency measures and protective facilities is also included.

621.311.161

631 THEORY OF ECONOMIC OPERATION OF INTERCONNECTED AREAS. R.H.Kerr and L.K.Kirchmayer.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 647-53 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Extends the theory and the co-ordination equations previously derived for optimum economy for a single area (see Abstr. 3911 of 1959) to obtain the co-ordination equations for optimum economic operation of a pool operated as a multiple-area system. The economic exchanges between areas may be obtained by comparison of incremental costs at the boundaries between areas. In many applications these principles for economic despatch of a power pool for multi-area operation offer advantages over treatment of the pool as a single operating area. A.P.Wilmshurst

621.311.21

632 THE NEW BROWNLEE POWER STATION.

Elect. J., Vol.163, No.24, 1302-5 (Dec. 11, 1959).

This station in U.S.A. contains four outdoor, vertical umbrella type 90 MW generators. Each of the turbines is rated at 142 000 h.p. at a gross head of 235 ft and operated at 128.6 rev/min. Provision have been made for two additional units if required. A brief description is given of the turbines, generators and control system.

Central Electricity Generating Board Digest

621.311.21

633 THE BEAUHARNOIS No. 3 DEVELOPMENT. Y. de Guise and C.Forest.

Engng J., Vol. 42, No. 9, 64-73 (Sept., 1959).

The final stage of the St.Lawrence river scheme comprises 10 propeller turbines driving 13.8 kV 65 MVA alternators designed for full run-away speed; they are connected in pairs to 110 kV transformers. Special arrangements were made to provide a supply of ice-free cooling water. P.Linton

621.311.21

634 THE STORAGE POWER STATION ROSELEND–BATHIE IN SAVOY.

Schweiz. Bauztg, Vol. 77, No. 35, 563-6 (Aug. 27, 1959). In German.

The Roselend reservoir on the upper Isere, France, stores 187×10^6 m^3 behind an 800 m long arch dam 150 m high; a second reservoir at St.Guerin stores 13×10^6 m^3. The 12.6 km long gallery, 4.2 m dia., is followed by a steep pressure shaft leading to the underground station. Six 428 rev/min 2-jet Pelton turbines drive 88 MVA 10.5 kV alternators connected solidly to 220 kV or 380 kV underground transformers. P.Linton

621.311.21

635 EXPERIENCE IN THE OPERATION OF THE MAUVOISIN GROUP OF POWER STATIONS.

Schweiz. Bauztg., Vol. 77, No. 39, 645-54 (Sept. 24, 1959). In German.

See Abstr. 2779 of 1953 for a complete description of the plant. Details are given of the exhaustive tests carried out to determine the deformation of the dam and tunnels, together with the temp. distribution. Brief mention is made of some changes in materials which were necessary in the bearings of the hydro-electric units and in the valves. R.G.Jakeman

621.311.22

636 CLEANING POWER STATION PIPEWORK USE OF COMPRESSED AIR WITH SAND OR WATER FOR REMOVING INTERNAL DEPOSITS. F.J.Halligey.

Elect. Times, Vol. 136, 711-12 (Dec. 10, 1959).

621.311.22

637 DRY COOLING TOWERS AND JET CONDENSING PLANT.

Engineer, Vol. 208, 729-31 (Dec. 4, 1959).

In the "dry cooling tower" system described, exhaust steam from the turbines gives up heat to cooling water sprayed into a jet condenser. Part of the resulting mixture of condensate and cooling water returns through the feed heating system to the boiler. The rest is pumped through finned cooling elements arranged in a cylindrical stack round the base of the cooling tower to reject heat to atmosphere. The closed circuit eliminates the evaporative loss associated with ordinary "wet" cooling towers and dispenses with the need for make-up water.

621.311.25

638 ELECTRICAL FEATURES OF INDIAN POINT NUCLEAR ELECTRIC GENERATING STATION. T.D.Reimers.

Trans Amer. Inst. Elect. Engrs I, Vol. 77, 879-84 (1959) = Commun. and Electronics, No. 40 (Jan., 1959).

At the present state of nuclear reactor development there are certain requirements of nuclear plants which necessitate modifications in conventional generating station electrical design. These requirements are: (a) reactor safety, involving changes in auxiliary power supply, control sources, controls and instrumentation; (b) the presence of radioactivity, humidity and temperature in the reactor sphere which presents an insulation problem; (c) the large capacity of the generator (275 MW) with respect to a high impedance tie; this may give rise to stability and voltage problems. The differences from conventional plants and the design modifications which result are discussed. G.V.Hargreaves

621.311.25

639 LATINA: PROGRESS REPORT ON CONSTRUCTION. M.Campanini.

Nuclear Engng, Vol. 4, 329-31 (Oct., 1959).

621.311.25

640 LATINA: COMPARISONS WITH BRADWELL. R.D.Vaughan and G.Calabria.

Nuclear Engng, Vol. 4, 331-4 (Oct., 1959).

621.311.25

641 LATINA: DETAILS OF THE BOILERS. B.G.Ediss and E.Torielli.

Nuclear Engng, Vol. 4, 334-5 (Oct., 1959).

621.311.25

642 LATINA: LAYOUT OF THE CONTROLS. T.Coxon.
Nuclear Engng, Vol. 4, 336-9 (Oct., 1959).

621.311.25

643 LATINA: HANDLING OF ACTIVE EFFLUENTS. L.N.Snell and R.T.Brunskill.
Nuclear Engng, Vol. 4, 339-42 (Oct., 1959).

621.311.4

644 ECONOMICAL SIZE AND LOCATION OF 22/6 (35/10) kV TRANSFORMER STATIONS FOR MUNICIPAL NETWORKS. B.Pavlovský.
Elektrotech. Obzor, Vol. 48, No. 9, 451-7 (1959). In Czech.

With increasing consumption the re-inforcement of 6 or 10 kV systems by superposed 22 or 35 kV systems becomes of interest. Here the economical size and location of 22/6, or 35/10 kV transformer stations is investigated. Considering costs of investment and running losses a differential equation is derived, which is solved graphically. The economical transformer distance in km is $l = kF^{-\frac{1}{3}}$ and the economical rating in MVA is $S = k^2F^{\frac{1}{3}}$, where F is the load density in MVA/km^2 and k a coefficient varying between 3.9 and 4.25. Calculations illustrate the usefulness of the method. N.Klein

621.311.442

645 POWER SUPPLY DESIGN USING SILICON DIODES. H.A.Kampf.
Electronics, Vol. 32, No. 40, 60-2 (Oct. 2, 1959).

Explains how silicon diodes may be used for high voltages at high currents. The peak inverse voltage and peak forward current seen by the rectifier must be calculated for the particular rectifier circuit, load characteristics, filter and internal impedance of the a.c. source. This operation is described for rectifiers supplying up to 200 VA, based upon measurement of the transformer short-circuit impedance and the ratio of its d.c. resistance to inductive reactance. The application to high-power circuits is described and several transient suppression schemes are compared. After outlining ways of achieving an even voltage division in a long string of diodes, cooling requirements are considered. A block diagram and photographs of an 8 kV 25 A equipment are included. E.F.Hansford

621.311.69 : 621.396.61

646 CURRENT SUPPLY USING WIND POWER AT THE SCHÖNEBERG (EIFEL) DECIMETRE [WAVELENGTH] RADIO STATION AND THE EXPERIENCES GAINED THEREWITH. G.Rüsseler.
Nachrichtentech. Z.(N.T.Z.), Vol. 12, No. 7, 352-60 (July, 1959). In German.

A detailed illustrated description of this wind power station. The choice of wind power was caused by the fact that the station is situated a considerable distance from the grid system, and wind conditions at its location on a mountain 670 m above sea level were most favourable. The plant consists of two wind motors of 6 kW rated output at a wind speed of 9 m/s, coupled over double-toothed gearing to d.c. generators with differential excitation and 6 kW rated output at 220-310 V. An accumulator battery of 110 cells for 216 Ahr and a Diesel emergency set are provided. Two d.c.–a.c. motor–generators supply the current to the devices used for the radio equipment. During the test period the requirements for this equipment were repeatedly increased, but the wind supply still exceeded the energy demand. This is shown in graphs covering August 1955 to May 1957. An unsolved problem is the formation of ice on the blades of the wind motor. R.Neumann

ELECTRIC MACHINES

621.313.1

647 ON THE QUESTION OF STEP-FORMATION ON THE COMMUTATION CURVE OF CURRENT IN THE ARMATURE COIL. V.Pek.
Elektrotech. Obzor, Vol. 48, No. 8, 432-6 (1959). In Czech.

Kluge (see Abstr. 2482 of 1956) recognizes two reasons for fluctuations in the commutation curve: (a) vibrations of the brushes; and (b) induction in neighbouring coils. A further reason is discussed here, which is found in the shape of the commutating pole. To prove this, the commutation curves of a d.c. machine are calculated making use of Dreyfus' theory of commutation. In the case of symmetrical commutating pole-shoes, vibrations occur, while, with another shape of the shoes, vibrations are avoided. N.Klein

621.313.1-981.4

648 MINIATURE MOTORS. THEIR DESIGN, PERFORMANCE AND APPLICATION. E.H.Werninck.
Elect. Rev., Vol. 165, No. 20, 913-17 (Dec. 25, 1959).

Various types of motors with outputs below $\frac{1}{4}$ h.p. are surveyed generally from the point of view of the customer. Their applications are illustrated by typical examples drawn from the commercial, domestic and control fields.

621.313.2-8

649 MAGNETIZING PERFORMANCE OF SHORT-CIRCUIT GENERATORS. L.Fogaras.
Elteknik, Vol. 2, No. 8, 129-32 (Oct., 1959).

A discussion of two methods of keeping the transient s.c. current constant during the s.c. time in order to obtain high interrupting powers while carrying out high-power tests. With super-excitation, the generator is excited to the required voltage before the test. At the instant of s.c. a resistor in the field circuit is short-circuited. With flying excitation, the exciter, previously excited to a certain voltage, is switched on to the field coils. The characteristics of the 2 methods are developed and numerical examples are given. A short bibliography is added. R.G.Jakeman

621.313.3

650 APPLICATION OF SEPARATELY AND SHUNT-EXCITED GENERATORS IN A MOTOR-GENERATOR SYSTEM. Yu.R.Reingol'd.
Elektrichestvo, 1959, No.5, 22-5 (May). In Russian.

By adding shunt-excitation to a separately-excited generator a significant saving in external power is achieved, which results in a considerable reduction in weight of the automatic regulation equipment (transformer, rectifier, magnetic amplifier). It is shown, mathematically, that although the inertia pf the system increases, the shunt excitation improves the so-called usefulness coefficient (ratio of amplification factor and the time constant). Limits are found within which the percentage shunt excitation should be selected to avoid self-excitation and an excessive increase of remnant magnetism. B.Karlsbad

621.313.3.017.4

651 REDUCING BRUSH LOSSES. O.E.Mainer.
Elect. J.,Vol. 163, No. 14, 598-9 (Oct. 2, 1959).

An investigation into the loss caused by the current across the brush due to the transformer e.m.f. in the short-circuited coil of an a.c. commutator motor. Methods of testing are described and comparative results are given for single and sandwich brushes. Two grades of Morgan Crucible brushes were tested, EG8101 and IM3. The effect of sandwiching was marked for the former but not for the latter. R.G.Jakeman

621.313.322-81

652 THE ANALYSIS OF SUDDEN-SHORT-CIRCUIT OSCILLOGRAMS OF STEAM-TURBINE GENERATORS. D.Harrington and J.I.Whittlesey.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 551-65 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

An analysis of the oscillogram records obtained from sudden short-circuit tests on synchronous generators yields test values of subtransient and transient reactances and time constants. Using a computer to analyse the test data leads to a much more rapid assessment of results than hand methods of analysis. One method of analysis which has been programmed for the computer, the "straight lines" method, is basically similar to a method used by hand. For this method the envelope lines of the current trace are drawn directly on the oscillogram and the vertical amplitude of the envelope is measured at the desired time intervals. A brief description of how the computer programme is used is followed by a discussion of how the analysis is made in the programme and a description of the computer output. Appendix 1 gives an analysis of the "straight lines" method. Appendix 2 describes the "determination of the resolved direct component of armature current". G.V.Hargreaves

621.313.33

653 RATING DETERMINATION OF ASYNCHRONOUS MOTORS CONTROLLED BY VOLTAGE REGULATION. V.M.Terekhov.
Elektrichestvo, 1959, No. 7, 32-5 (July). In Russian.

Analytical and graphical solutions for selecting a motor of reliable durability are presented. The driven mechanisms are derived into two groups according to the form of the torque graph. The solution results are compared with experimental data and proved to be accurate. These types of motors are advised: (1) for driving less powerful devices, where the economical characteristics have a secondary importance, the decisive factors being high reliability and simplicity (centrifugal separators, pumps, fuel and raw material feeders of boilers and ovens, builders cranes etc.); and (2) for driving more powerful devices with a narrow speed range (smoke extractors, ventilators and centrifugal pumps).

Z.Koprowski

621.313.33

654 TRANSIENT TORQUES OF AN INDUCTION MOTOR WITH BLOCKED ROTOR. F.Pavlásek.
Elektrotech Obzor, Vol.48, No.8, 410-15 (1959). In Czech.

Transient torques, arising when such a motor is connected to the network are considerably larger than the steady-state starting torque. These transient torques are investigated analytically and results compared with oscillographic records of torque measurements obtained with the help of a piezoelectric transducer. The transient torque maxima are six to ten times the nominal moment. The transient pulsates at system frequency and is damped out within 0.75–2 sec. These transients might cause defects in squirrel-cage armatures and account should be taken of them, when designing the shaft.

N.Klein

621.313.333 : 621.317.38

655 DYNAMICAL MEASUREMENT OF THE TORQUE CHARACTERISTIC. F.Pavlasek.
Elektrotech. Obzor, Vol. 48, No. 9, 468-72 (1959). In Czech.

Determination of the torque-slip characteristic of induction motors by static methods is laborious. The dynamical method, described, gives results quickly. The torque is measured by means of a piezoelectric transducer and the voltage is applied to the vertical plates of an oscilloscope. The speed, applied to the horizontal plates is measured with a tacho-dynamo, especially built with a stationary magnetic circuit. The oscillograms show transient pulsations superposed on the characteristic. To avoid recording the torque pulsations the characteristic is taken when the motor is connected for reverse run.

N.Klein

621.313.333

656 THEORY OF END-WINDING LEAKAGE REACTANCE. V.B.Honsinger.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 417-26 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

A theoretical study of induction motor end-winding leakage reactance. The mathematical analysis takes account of main winding dimensions, such as length, diameter, coil shape and coil pitch and allows for the effect of magnetic materials which surround the end winding. A general formula for end-winding leakage inductance is derived together with a number of simplified equations. There is a short bibliography and discussion.

H.Sterling

621.313.333.2 : 621.67

SQUIRREL-CAGE MOTORS IN SUBMERSIBLE PUMPING PLANT. See Abstr. 608

621.313.333

657 SWITCHING TRANSIENTS IN SINGLE-PHASE INDUCTION MOTORS WITH CONSTANT SPEED. P.Venkata Rao.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 713-23 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

The method of symmetrical components of instantaneous potentials and currents is applied to the analysis of transient conditions in a capacitor-start capacitor-run single-phase induction motor with constant speed, and with special reference to reclosing and plugging. Detailed computation is carried out for the transient currents and torque produced when a capacitor motor running at full speed is suddenly taken off the lines, and then put back after an extremely brief interval. The problems of sudden short-circuiting of stator terminals and plugging are also analysed. It is found that if the motor is reclosed when the applied potential passes through its zero value there is a fundamental-frequency slowly-decaying torque superimposed on the average steady-state unidirectional torque. If, on the other hand, the motor is switched on to the supply when the applied potential passes through its maximum value, the developed electromagnetic torque settles down to its final value before the end of the third cycle of the applied a.c. potential. In order to plug the motor satisfactorily it is absolutely necessary to first replace the running capacitor by the starting capacitor before the electric connections for one of the windings are interchanged.

TRANSFORMERS

621.314.2

658 A REVIEW OF THE INFLUENCE OF RECENT MATERIAL AND TECHNIQUE DEVELOPMENT ON TRANSFORMER DESIGN. H.M.Nordenberg.
I.R.E. Trans Compon. Parts, Vol. CP-6, No. 3, 201-9 (Sept., 1959).

621.314.2

659 INTERLEAVED TRANSFORMER WINDINGS. J.B.Price.
Elect. Rev., Vol. 165, No. 20, 927-30 (Dec. 25, 1959).

Describes the interleaved disk winding, which has the advantage of reducing impulse stresses both during the initial period and the subsequent transient period.

621.314.2

660 THE CALCULATION AND MEASUREMENT OF AXIAL ELECTROMAGNETIC FORCES ON CONCENTRIC COILS IN TRANSFORMERS. M.F.Beavers and C.M.Adams.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 467-78 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Uses the theoretical relationships for two-dimensional current sheets in conjunction with the method of images to obtain an approximate equation for the axial forces. The application of this equation to a practical case necessitates the use of an electronic computer. To establish the degree of accuracy of the equations, force measurements were made, but were confined to those forces acting on whole windings having large displacements; for such cases an error of about 20% was found.

M.R.Dickson

621.314.2

661 ARE STABILIZING WINDINGS NECESSARY IN ALL Y-CONNECTED TRANSFORMERS? B.A.Cogbill.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 963-70 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

For many years it has been common practice to include a delta-connected stabilizing winding in Y–Y connected transformers and Y-connected autotransformers. This applies to 3 ph. units of all types of core construction, as well as to 3 ph. banks of s.ph. units. The practice has been followed so closely for so many years that it is generally taken for granted that the stabilizing winding is a necessary part of such transformers. In many cases it is; but is it necessary or even desirable to include a stabilizing winding in all cases, regardless of system characteristics and conditions? A comprehensive examination is given of the elements which determine the answer or answers to this question, in the light of modern power system operating conditions and operating practice.

621.314.2.012.8

662 AN EQUIVALENT CIRCUIT FOR TRANSFORMERS IN WHICH NONLINEAR EFFECTS ARE PRESENT. H.W.Lord.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 580-6 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

A limitation of the T-equivalent circuit is shown and it is demonstrated that the π-equivalent circuit has no such limitation.

POWER CONVERSION

621.314.26

663 CALCULATION OF THE OPEN-CIRCUIT OPERATION OF A FREQUENCY DOUBLER. V.A.Rayushkin.
Elektrichestvo, 1959, No. 5, 66-7 (May). In Russian.

Open-circuit operation has to be calculated when a frequency doubler, used as a measuring transformer, is designed. A comparatively simple method is proposed for this calculation which takes into account up to the fourth harmonic. Effective resistance and leakage of the windings, hysteresis and eddy-current losses in the core are all neglected, and the reactance of the choke is assumed to be so high that no current flows at double frequency. An approximating analytical expression is adopted for the magnetization curve, and formulae are derived for the magnetic induction. Conditions are discussed in which the fourth harmonic of the output voltage reaches relatively high values. Analytical results agree with experimental data. J.M.Silberstein

621.314.65

664 THE EFFECT OF INTERMEDIATE ELECTRODES ON THE AUTONOMOUS DISCHARGE FIRING VOLTAGE IN HIGH VOLTAGE METAL-TANK MERCURY-ARC RECTIFIERS.
S.V.Ptitsyn, D.D.Aleksandrov and N.F.Olendzkaya.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1278-83 (Aug., 1959). In Russian.

Describes an experimental sectionalized rectifier. The results show that, with a mercury-vapour pressure exceeding the normal working pressure, the presence of intermediate electrode-inserts between the grid and anode halves the interelectrode spacing needed for development of the discharge, which implies a corresponding increase in the firing voltage. Some data are included on the effect of the number and geometry of the inserts on the position of the Paschen curves. D.E.Brown

621.314.65

665 DATA ON THE DIVISION OF THE CATHODE SPOT IN A LOW PRESSURE MERCURY ARC RECTIFIER.
I.G.Kesaev.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1289-94 (Aug., 1959). In Russian.

The experimental data described and illustrated include dividing spot distribution as a function of life, distribution of time intervals between successive divisions, interaction of spots after division, causes of division and spot structure. D.E.Brown

621.314.65

666 THE FORMATION OF LUMINOUS SPOTS ON AN ANODE. N.A.Neretina and B.N.Klyarfel'd.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1301-5 (Aug., 1959). In Russian.

Describes experimental work with mercury-vapour and hydrogen-filled tubes showing that the electronic temperature and positive ion generation density are high inside an anode spot. The ion current from the spot on discharge reduces the anode drop; this action produces l.f. voltage oscillations on a small anode, or grouping of the spots in straight lines in the case of a large anode. D.E.Brown

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667 THE MEASUREMENT OF GAS DENSITY IN THE DYNAMIC DISCHARGE STATE. A.A.Timofeev.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1306-10 (Aug., 1959). In Russian.

Gives a brief general description of a method of using probes in the gas discharge space, working on a principle of puncturing the negative volume charge layer round the probe; the positive branch of the V–A probe characteristic is then studied. Experimental curves include mercury-vapour density variation during a current pulse in a calibrated valve, calibration curves of puncture voltage against mercury-vapour density for cylindrical probe, and mercury-vapour density variation during a current period at different points of an h.v. rectifier. D.E.Brown

621.314.67

668 A POSSIBLE METHOD OF PROTECTION AGAINST BACKFIRES IN HIGH-POWER RECTIFIERS.
E.P.Khmel'nitskii.
Radiotekhnika, Vol. 14, No. 7, 71-7 (July, 1959). In Russian.

Steep-fronted initial inverse voltage is one of the main causes of backfires. In addition to anode damping circuits a rapidly saturating reactor was introduced in each phase which reduced the initial surge to the quarter of original value. Calculation is given for obtaining the values and dimensions of components. P.Szekely

POWER TRANSMISSION
OVERHEAD LINES . CABLES

621.315.051.024

669 WORK DONE IN THE SOVIET UNION ON HIGH-VOLTAGE LONG-DISTANCE D.C. POWER TRANSMISSION. A.M.Nekrasov and A.V.Poase.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 515-22 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

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621.315.051.24

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621.315.17

671 THE BRITISH COLUMBIA ELECTRIC COMPANY'S 360 kV AND 230 kV TRANSMISSION LINE DESIGNS.
L.H.J.Cook.
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Compares the latest steel tower designs for 360 kV and 230 kV systems with former designs to illustrate the advantages gained by coordinating basic assumptions with minimum safe requirements indicated by operating experience. Tables of tower weights, insulation and clearance requirements, graphs relating cost per mile to conductor tension, drawings of tower outline showing main dimensions, and a map of the complete transmission system are given. G.V.Hargreaves

621.315.174

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621.315.174

673 PROGRESS TOWARD OPTIMUM DAMPING OF TRANSMISSION CONDUCTORS. J.E.Sproule and A.T.Edwards.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 844-52 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

621.313.33

653 RATING DETERMINATION OF ASYNCHRONOUS MOTORS CONTROLLED BY VOLTAGE REGULATION. V.M.Terekhov.
Elektrichestvo, 1959, No. 7, 32-5 (July). In Russian.

Analytical and graphical solutions for selecting a motor of reliable durability are presented. The driven mechanisms are derived into two groups according to the form of the torque graph. The solution results are compared with experimental data and proved to be accurate. These types of motors are advised: (1) for driving less powerful devices, where the economical characteristics have a secondary importance, the decisive factors being high reliability and simplicity (centrifugal separators, pumps, fuel and raw material feeders of boilers and ovens, builders cranes etc.); and (2) for driving more powerful devices with a narrow speed range (smoke extractors, ventilators and centrifugal pumps).

Z.Koprowski

621.313.33

654 TRANSIENT TORQUES OF AN INDUCTION MOTOR WITH BLOCKED ROTOR. F.Pavlásek.
Elektrotech Obzor, Vol.48, No.8, 410-15 (1959). In Czech.

Transient torques, arising when such a motor is connected to the network are considerably larger than the steady-state starting torque. These transient torques are investigated analytically and results compared with oscillographic records of torque measurements obtained with the help of a piezoelectric transducer. The transient torque maxima are six to ten times the nominal moment. The transient pulsates at system frequency and is damped out within 0.75–2 sec. These transients might cause defects in squirrel-cage armatures and account should be taken of them, when designing the shaft.

N.Klein

621.313.333 : 621.317.38

655 DYNAMICAL MEASUREMENT OF THE TORQUE CHARACTERISTIC. F.Pavlasek.
Elektrotech. Obzor, Vol. 48, No. 9, 468-72 (1959). In Czech.

Determination of the torque-slip characteristic of induction motors by static methods is laborious. The dynamical method, described, gives results quickly. The torque is measured by means of a piezoelectric transducer and the voltage is applied to the vertical plates of an oscilloscope. The speed, applied to the horizontal plates is measured with a tacho-dynamo, especially built with a stationary magnetic circuit. The oscillograms show transient pulsations superposed on the characteristic. To avoid recording the torque pulsations the characteristic is taken when the motor is connected for reverse run.

N.Klein

621.313.333

656 THEORY OF END-WINDING LEAKAGE REACTANCE. V.B.Honsinger.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 417-26 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

A theoretical study of induction motor end-winding leakage reactance. The mathematical analysis takes account of main winding dimensions, such as length, diameter, coil shape and coil pitch and allows for the effect of magnetic materials which surround the end winding. A general formula for end-winding leakage inductance is derived together with a number of simplified equations. There is a short bibliography and discussion.

H.Sterling

621.313.333.2 : 621.67

SQUIRREL-CAGE MOTORS IN SUBMERSIBLE PUMPING PLANT. See Abstr. 608

621.313.333

657 SWITCHING TRANSIENTS IN SINGLE-PHASE INDUCTION MOTORS WITH CONSTANT SPEED. P.Venkata Rao.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 713-23 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

The method of symmetrical components of instantaneous potentials and currents is applied to the analysis of transient conditions in a capacitor-start capacitor-run single-phase induction motor with constant speed, and with special reference to reclosing and plugging. Detailed computation is carried out for the transient currents and torque produced when a capacitor motor running at full speed is suddenly taken off the lines, and then put back after an extremely brief interval. The problems of sudden short-circuiting of stator terminals and plugging are also analysed. It is found that if the motor is reclosed when the applied potential passes through its zero value there is a fundamental-frequency slowly-decaying torque superimposed on the average steady-state unidirectional torque. If, on the other hand, the motor is switched on to the supply when the applied potential passes through its maximum value, the developed electromagnetic torque settles down to its final value before the end of the third cycle of the applied a.c. potential. In order to plug the motor satisfactorily it is absolutely necessary to first replace the running capacitor by the starting capacitor before the electric connections for one of the windings are interchanged.

TRANSFORMERS

621.314.2

658 A REVIEW OF THE INFLUENCE OF RECENT MATERIAL AND TECHNIQUE DEVELOPMENT ON TRANSFORMER DESIGN. H.M.Nordenberg.
I.R.E. Trans Compon. Parts, Vol. CP-6, No. 3, 201-9 (Sept., 1959).

621.314.2

659 INTERLEAVED TRANSFORMER WINDINGS. J.B.Price.
Elect. Rev., Vol. 165, No. 20, 927-30 (Dec. 25, 1959).

Describes the interleaved disk winding, which has the advantage of reducing impulse stresses both during the initial period and the subsequent transient period.

621.314.2

660 THE CALCULATION AND MEASUREMENT OF AXIAL ELECTROMAGNETIC FORCES ON CONCENTRIC COILS IN TRANSFORMERS. M.F.Beavers and C.M.Adams.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 467-78 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Uses the theoretical relationships for two-dimensional current sheets in conjunction with the method of images to obtain an approximate equation for the axial forces. The application of this equation to a practical case necessitates the use of an electronic computer. To establish the degree of accuracy of the equations, force measurements were made, but were confined to those forces acting on whole windings having large displacements; for such cases an error of about 20% was found.

M.R.Dickson

621.314.2

661 ARE STABILIZING WINDINGS NECESSARY IN ALL Y-CONNECTED TRANSFORMERS? B.A.Cogbill.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 963-70 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

For many years it has been common practice to include a delta-connected stabilizing winding in Y–Y connected transformers and Y-connected autotransformers. This applies to 3 ph. units of all types of core construction, as well as to 3 ph. banks of s.ph. units. The practice has been followed so closely for so many years that it is generally taken for granted that the stabilizing winding is a necessary part of such transformers. In many cases it is; but is it necessary or even desirable to include a stabilizing winding in all cases, regardless of system characteristics and conditions? A comprehensive examination is given of the elements which determine the answer or answers to this question, in the light of modern power system operating conditions and operating practice.

621.314.2.012.8

662 AN EQUIVALENT CIRCUIT FOR TRANSFORMERS IN WHICH NONLINEAR EFFECTS ARE PRESENT. H.W.Lord.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 580-8 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

A limitation of the T-equivalent circuit is shown and it is demonstrated that the π-equivalent circuit has no such limitation.

POWER CONVERSION

621.314.26

663 CALCULATION OF THE OPEN-CIRCUIT OPERATION OF A FREQUENCY DOUBLER. V.A.Rayushkin. Elektrichestvo, 1959, No. 5, 66-7 (May). In Russian.

Open-circuit operation has to be calculated when a frequency doubler, used as a measuring transformer, is designed. A comparatively simple method is proposed for this calculation which takes into account up to the fourth harmonic. Effective resistance and leakage of the windings, hysteresis and eddy-current losses in the core are all neglected, and the reactance of the choke is assumed to be so high that no current flows at double frequency. An approximating analytical expression is adopted for the magnetization curve, and formulae are derived for the magnetic induction. Conditions are discussed in which the fourth harmonic of the output voltage reaches relatively high values. Analytical results agree with experimental data. J.M.Silberstein

621.314.65

664 THE EFFECT OF INTERMEDIATE ELECTRODES ON THE AUTONOMOUS DISCHARGE FIRING VOLTAGE IN HIGH VOLTAGE METAL-TANK MERCURY-ARC RECTIFIERS. S.V.Ptitsyn, D.D.Aleksandrov and N.F.Olendzkaya. Radiotekhnika i Elektronika, Vol. 4, No. 8, 1278-83 (Aug., 1959). In Russian.

Describes an experimental sectionalized rectifier. The results show that, with a mercury-vapour pressure exceeding the normal working pressure, the presence of intermediate electrode-inserts between the grid and anode halves the interelectrode spacing needed for development of the discharge, which implies a corresponding increase in the firing voltage. Some data are included on the effect of the number and geometry of the inserts on the position of the Paschen curves. D.E.Brown

621.314.65

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It is shown that the standard vibration damper installation using two torsional dumbbell dampers per span provides more damping than necessary, and that one torsional dumbbell damper per span, for span lengths up to 1700 ft, with substantially reduced weights for the larger conductors, provides adequate protection against fatigue failure arising from aeolian vibration. The conclusions are supported by experimental data and by inspections of lines. The results of tests using one damper per span are compared with performance data of typical armour reinforcing rods.

621.315.232

674 EFFECTS OF TAMPING AND PAVEMENT BREAKING ON ROUND CONDUIT. G.F.Weissmann and D.M.Mitchel.
Bell Syst. tech. J., Vol.38, No.6, 1581-94 (Nov., 1959).

Underground conduits may be subjected to low-frequency dynamic loads caused primarily by the operation of mechanical tamping and pavement-breaking machines. These external loads will produce circumferential bending moments in the conduit wall. The magnitude of the bending moments has been determined by measurement of the circumferential fibre strains in thin-walled metal tubes subjected to the external dynamic forces transmitted through various soil media. Finally, the bending moments are expressed in terms of the equivalent crushing strength.

INSULATORS
SUPPORTS . CONNECTIONS

(See also Insulating Materials)

621.315.62

675 EXTRA-HIGH-VOLTAGE INSULATORS. W.G.Robinson.
Elect. Rev., Vol.166, No.1, 3-6 (Jan. 1, 1960).

Characteristics of transmission line and post insulators for the 275 kV supergrid and other high-voltage systems are considered in relation to the relevant and the recommendations. They are generally developments of well-proven types and no radically new designs have been found necessary.

621.315.62

676 THE DIELECTRIC STRENGTH OF PORCELAIN INSULATORS IN WEAKLY CONDUCTING OIL. J.Chmelíček.
Elektrotech. Obzor, Vol.48, No.8, 423-9 (1959). In Czech.

It is difficult to determine the dielectric strength of insulators owing to flashovers. It has become customary therefore to immerse insulators for puncture tests in oil and especially in weakly conducting oils. Results of puncture tests of insulators immersed alternatively in transformer oil and in weakly conducting oil of 2×10^6 Ω cm resistivity at 20° C are given. Eight types of insulators were tested and breakdown voltages were, in extreme cases, 12% higher when the immersion medium was the weakly conducting oil. At the other extreme, immersion in transformer oils resulted in values higher by 4%. It is proposed to standardize tests in weakly conducting oils. N.Klein

621.315.62

677 THE EFFECT OF RAIN ON R.I.V. CHARACTERISTICS OF HIGH-VOLTAGE SUSPENSION ASSEMBLIES. J.Kaminski, B.E.Kingsbury and F.C.Vose.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 669-72 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

The R.I.V. characteristics of the assemblies under dry conditions are reported elsewhere (Abstr. 3955 of 1958). The present work gives results of an investigation of the effects on R.I.V. of conductor diameter and arrangement (single or dual conductors) in unshielded and shielded assemblies under both dry and wet conditions. Additional measurements were made to assess the radio interference from the conductors alone. An 18-unit suspension string was used in tests involving the use of insulators and the conductors' diameters were 1 and 2 in. E.M.Dembinski

621.315.66

678 THE WOODEN MAST AND ITS FUTURE FOR OVERHEAD DISTRIBUTION LINES. J.Stösser.
Bull. Assoc. Suisse. Elect., Vol. 50, No. 16, 817-24 (Aug. 1, 1959). In French.

Although in the long run concrete posts are likely to compete successfully with wooden masts, new methods of impregnation of the latter extend their use more economical than hitherto. The copper sulphate method of impregnation is on its way out in Switzerland. R.Schnurmann

DISTRIBUTION . INSTALLATIONS

621.316.11 : 681.142

A.C. NETWORK ANALYSERS. See Abstr. 601

621.316.35

679 LABORATORY AND FIELD-TEST EXPERIENCE WITH HIGH-CAPACITY ISOLATED PHASE BUSSES. G.E.Buchanan.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 925-31 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

The isolated phase generator bus which has become a standard method for connecting generators to transformers is undoubtedly the safest and most satisfactory method of making this connection that has been developed. There are, however, several problems that have arisen with the advent of high currents normal to the large generators now being installed. The series of tests herewith discussed covers certain phenomena of induced and magnetic heating that may be encountered with the use of these high amperage busses, and also discusses the problems of field pressurizing of bus systems.

SWITCHGEAR

621.316.5 : 621.319.51

680 SPARK GAPS FOR FAST HIGH-VOLTAGE SWITCHING. H.B.McFarlane.
Electronics, Vol. 32, No. 31, 72-3 (July 31, 1959).

A spark-gap switch is used to initiate a shock wave by exploding a piece of wire, into which it discharges 100 capacitors (0.03μF each), previously charged to 30 kV, in about 100 mμsec. A total of 111 gaps is used in three consecutive sections, coupled by short lengths of cable which act as pulse-forming elements and also isolate each gap, so that its breakdown is independent of that of others in the same section. The operating time of the switch is claimed to be about 30 mμsec, with a jitter of less than 1 mμsec. T.H.D.Attewell

621.316.5

681 SPEEDS OF MOVEMENT OF ELECTRIC ARCS IN AIR. L.Féchant.
Rev. gen. Elect., Vol. 68, No. 9, 519-26 (Sept., 1959). In French.

Describes electrical and mechanical features of apparatus used to study the movement of an arc imposed by a magnetic field, as in magnetic blowouts, over a current range of 300 to 5000 A. Means for measuring the average and instantaneous speeds are outlined and various features affecting performance, such as air resistance, are discussed with illustrations of curves obtained in the course of the tests. A.P.Paton

621.316.57

682 SWITCHGEAR FOR H.V.D.C. LINES. G.A.Kukekor, P.G.Sorokin and N.A Shipulina.
Direct Curr., Vol. 4, No. 5, 123-6 (June, 1959).

Indicates the trend of research in U.S.S.R. and outlines the problem of supplying high-speed circuit-breakers for disconnecting the circuits of highly inductive e.h.v. systems operating on direct current. The circuit breaking process for a d.c. line is discussed and at present the most promising type of circuit-breaker is an air-blast breaker with an oscillatory current shunting the arc. A.P.Paton

621.316.57

683 PROGRESS IN THE QUESTION OF RECOVERY VOLTAGE (NEAR SHORT-CIRCUIT, METHOD OF FOUR PARAMETERS). A.Hochrainer.
Elektrotech. Obzor, Vol.48, No.8, 395-401 (1959). In Czech.

A general discussion about shapes of recovery voltages,

occuring between the contacts of circuit-breakers. Gives an empirical formula for the interrupting capacity of circuit breakers as a function of the principal frequency of the recovery voltage and derives the simplest relation for this frequency in terms of circuit parameters. Progress in the assessment of circuit breakers has been made by considering a second natural frequency in the recovery voltage, describing the voltage wave by four parameters. Use is made of this method here to derive relations for interrupting capacities in the case of near short-circuits. N.Klein

621.316.57 : 537.52

684 INVESTIGATIONS ON ARCS IN NEW TYPES OF QUENCHING CHAMBERS FOR RAPID D.C. SWITCHING.

F.Wegmann.
Electrotech. Z (E.T.Z.) A, Vol. 80, No. 10, 289-95 (May 11, 1959). In German.

A discussion of various quenching devices (multiple diaphragm chambers etc.) for arc discharges. In some cases magnetic forces are of importance. Diagrams of various quenching chambers are shown and there are data on the effect of various external conditions on the arc voltage gradient etc. J.D.Craggs

621.316.57.064.24

685 A LINE OF 115-kV THROUGH 460-kV AIR-BLAST CIRCUIT BREAKERS.

R.B.Shores, J.W.Beatty, H.T.Seeley and W.R.Wilson.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 673-91 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

The breakers are of modular, or building-block, design, which allows the user to stock fewer spare parts and substantially reduces the personnel training problem. The breakers are expected to reduce the outage time of high-capacity circuits for maintenance and inspection. They are rated to handle the high recovery rates encountered during power faults on transmission lines of high capacity systems. Part II discusses the utilization of a new design of gas-insulated current transformer by the air-blast breakers. Design details facilitate obtaining satisfactory protective relaying with current transformers on only one side of the interrupter contacts with a resulting substantial reduction in cost.

621.316.57.064.25

686 DEVELOPMENT OF A 230-kV 20 000-MVA OIL CIRCUIT BREAKER. F.L.Reese.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 449-55 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Describes, with illustrations, a high power breaker using the A.S.A. bushing, a multi-break type interrupter, and standard pneumatic operating mechanism. Features of the 345 kV, 25 000 MVA breaker previously reported (Abstr. 3584 of 1954) are incorporated. The test programme to which the breaker was submitted is given with results in tabular form including typical oscillograms. A.P.Paton

REGULATION

621.316.718.5 : 621.313.322-81

687 THE PERFORMANCE OF DISPLACEMENT GOVERNORS UNDER STEADY-STATE CONDITIONS.

J.C.Prescott and A.K.El-Kharashi.
Proc. Instn Elect. Engrs, Paper 3179S, publ. Feb., 1960 (Vol. 107A, 85-95).

The method of speed control most generally used at the present time relies upon the centrifugal governor which controls the power admitted to a driving machine, generally a prime mover, in relation to the difference between the speed of the machine shaft and a selected basic or no-load speed. Other methods of control are, however, possible, and one which appears to have certain advantages is that in which the power input is controlled in relation to the angular displacement between the machine shaft and another shaft which rotates at a defined and constant angular velocity. This has been called displacement governing, and an attempt is made here to investigate the performance of displacement governors when controlling the power supply to turbo-alternators working in the steady state. The performance of such governors under transient conditions has already received attention, but as far as the present authors are aware, the steady-state performance has not been explicitly treated before.

621.316.718.5

688 SPEED REGULATION OF A.C. CRANE MOTORS. J.Dufroy.

Tech. mod., Vol. 51, No. 7, 19-22 (July, 1959). In French.

A method is described in which an auxiliary motor is coupled to the main motor having 4 times the number of poles of the latter. Characteristic curves are given. Another method of speed regulation for braking is the use of the Hydrel thrustor. This consists of a centrifugal pump compressing oil under a piston and producing a straight-line thrust to operate the brake. The motor is supplied either from the mains or from the main rotor. A diagram of connections and characteristic curves are given. R.G.Jakeman

621.316.721 : 621.318.381

689 A SIMPLE CURRENT STABILIZER FOR ELECTRO-MAGNETS. M.H.N.Potok.

Electronic Engng, Vol. 31, 745-7 (Dec., 1959).

The electromagnet concerned required about 10A at 100V : the various methods of supplying it are briefly reviewed and the solution adopted is described. The power is supplied by an Amplidyne. Transistors are used to reduce ripple and a d.c. amplifier is employed to overcome slow drift.

621.316.722

690 THE USE OF SERIES CAPACITORS ON MEDIUM VOLTAGE NETWORKS.

Quad. Stud. Not., Vol. 15, 671-80 (Oct. 16, 1959). In Italian.

Voltage control of m.v. networks is usually effected by on-load tap-changers or series boosters; the use of shunt connected capacitors is not generally economical, whilst series connected units present difficult protection problems. A graphical method of determining appropriate values of series types is presented and protective gear arrangements described. An account is given of operational experience gained on a 20 mile 15 kV overload line and oscillograms are included showing the results of short-circuit tests. M.Rathbone

621.316.722

691 FAST-RESPONSE STATIC AUTOMATIC VOLTAGE REGULATORS FOR HYDRO-ELECTRIC STATIONS.

D.C.Evans.
Water Pwr, Vol. 11, No. 9, 338-43 (Sept., 1959).

A description of the design and characteristics of modern regulators, which include magnetic amplifiers in the circuit. The various factors for fast-response regulators are explained and the operational advantages over the electromechanical types are pointed out. R.G.Jakeman

621.316.727

692 INCREASED POWER-FACTOR CORRECTION WITH SERIES CAPACITORS FOR 380 kV.

B.Nordström and L.Norlin.
Tekn. T., Vol. 89, No. 35, 909-10 (Sept. 25, 1959). In Swedish.

Series power factor correction enables the reactance of the transmission line to be compensated without endangering stability. It has been used so far on the Swedish 380 kV system with two sets of capacitor banks spaced at one-third distances from the ends of the line, so that the reactance should always be positive between the distance protection equipment and any possible line fault, even with as much as 65% compensation. It is shown that installing one large capacitor bank in place of the two is satisfactory from the point of view of safety and permits considerable savings on balancing capacitor installation costs against transmission losses. G.N.J.Beck

621.316.728 : 621.396.96

693 PRECISION HIGH-VOLTAGE TRANSISTOR-OPERATED POWER REGULATORS WITH OVERLOAD PROTECTION.

C.A.Franklin, P.M.Thompson and W.M.Caton.
Proc. Instn Elect. Engrs, Paper 3000E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 16, 714-25).

Recent developments in airborne radars call for low-noise power supplies at voltages very much greater than the maximum voltage ratings of available transistors. Discusses problems in the design of precision high-voltage regulators which can tolerate severe overloads and also meet the stringent requirements of, for example, an f.m. reflex klystron operating over the temperature range -55°C to +65°C. Three basic circuits are described and their inherent power and voltage limitations are discussed. It is shown that high-voltage regulators operating in either the series or shunt mode provide a satisfactory solution, particularly where only a single output is

required. However, the most economical approach for the particular case of a reflex-klystron supply is a low-voltage series regulator followed by a square-wave-oscillator type of d.c./d.c. convertor, since the convertor may have a multiplicity of output windings which can, for example, feed the resonator, reflector and filament of the klystron, respectively. The convertor type of design uses a high-current 20-volt regulated supply to control the amplitude of a square-wave oscillator operating at 8.5 kc/s. The output is 500 volts at 90 mA, the conversion efficiency from 20 volts is 80%, and the d.c. stability at the 500-volt level is better than ± 0.75 volt from -55 to + 65°C. The noise, including ripple, is less than 2 mV (r.m.s.). The addition of a negative-feedback loop between the output of the supply and the low-voltage series regulator improves the d.c. stability and reduces the output impedance.

PROTECTION

621.316.923 : 621.314.2

694 FUSE PROTECTION OF HIGH-VOLTAGE POWER TRANSFORMERS. R.A.Larner and K.R.Gruesen.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 864-78 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

A review of the present state of the art of fuse application based on study of their performances over 30 years.

621.316.925

695 SELECTION OF RELAYING QUANTITIES FOR DIFFERENTIAL FEEDER PROTECTION.
C.Adamson and E.A.Talkhan.
Proc. Instn Elect. Engrs, Paper 3137M, publ. Feb. 1960 (Vol. 107A, 37-47).

Differential feeder protection, in general, uses a single relaying quantity derived from all phases of the system being protected. The paper contains a comprehensive analysis of the nature of this relaying quantity for the whole range of single shunt faults and all likely combinations of phase-sequence quantities extracted from the faulted system. The analysis includes the well-established case of the summation transformer, this device having an output which contains positive, negative and zero phase-sequence components of current. The analysis is presented in the form of curves giving the relaying quantity in terms of the important components of the various phase-sequence impedances of the power system. From these curves it is possible to compare the different ways of deriving the single-phase relaying quantity and thence to specify the general rules for selection of phase-sequence networks. In order to provide a comprehensive method for determining a differential relaying quantity in magnitude and phase, a general chart has been developed; from this, the magnitude and phase of the relaying quantity, derived from any specified phase-sequence network, may be obtained graphically in terms of the positive and zero phase-sequence reactances and the zero-sequence resistance of the power system. Finally, the effect of load current on the magnitude of a derived relaying quantity has been considered. The corresponding effect on phase has not been treated since it has already appeared elsewhere, although the results have been included for purposes of comparison and completeness.

621.316.925

696 RELAYING FOR SYNCHRONOUS MOTOR PULLOUT PROTECTION.
A.H.Hoffman, C.Raczkowski and R.B.Squires.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 618-24 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

After discussing the relevant factors in pull-out protection and showing the effect of pull-out on the motor and on the power system, a new relay circuit is described which includes a saturating transformer in the field circuit. The theory is explained in detail and various oscillograms included. A bibliography and discussion are added. R.G.Jakeman

621.316.925

697 LOGIC STATIC SWITCHING PROMISES BETTER INDUSTRIAL LOAD CONTROL. F.K.Fox and R.A.Wise.
Elect. Wld, Vol. 151, No. 26, 98-9, 201 (June 29, 1959).

The relay protection of complex industrial power systems is usually a compromise between absolute protection of cable circuits against overload and security of supply. Random shutdowns may be avoided by the use of sensing devices as used in automatic control and computer technique which detect unusual conditions and make logical decisions as to the best course of action.

A.P.Wilmshurst

621.316.925.451 : 621.382

698 AN EXPERIMENTAL IMPEDANCE RELAY USING THE HALL EFFECT IN A SEMICONDUCTOR.
H.E.M.Barlow and J.C.Beal.
Proc. Instn Elect. Engrs, Paper 3136M, publ. Feb. 1960 (Vol. 107A, 48-50).

Describes a new type of "definite" impedance relay applicable to the protection of power transmission systems. Its operation is based upon a differential balance, under normal conditions, between the output from Hall effect in a semiconductor element and a rectifier unit. The experimental results obtained demonstrate the success of this instrument in principle and show that it has many advantages over the usual induction type of impedance relay.

621.316.93 : 621.316.722.1

699 CIRCUIT FOR THE PROTECTION OF A STABILISED TRANSISTOR POWER SUPPLY.
Mullard tech. Commun., Vol. 4, 299-302 (Aug., 1959).

The overload protection circuit described can switch off the supplies in less than 50 μs. The current at which the protection circuit operates can be set well below the full available output of the power supply. Thus experimental circuits, powered by the stabilized supply, will also be protected against any damage arising from faults within those circuits.

621.316.933

700 LIGHTNING ARRESTER FIELD TEST EQUIPMENT AND RESULTS. H.Linck.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 890-6 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

A novel field test method for lightning arresters has been developed. Impulse sparkover and power frequency leakage tests in the field can be carried out, with portable test equipment, on line-type and station-type lightning arresters with single-unit ratings up to 37 kV. Design and operating principles of this equipment are described; the field test results indicate that with the new method it is possible reliably to detect arresters not performing according to requirements.

621.316.94

701 FERRORESONANCE IN SERIES CAPACITOR–DISTRIBUTION TRANSFORMER APPLICATIONS.
E.F.Kratz, L.W.Manning and M.Maxwell.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 438-9 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

A comprehensive investigation into ferroresonance phenomena, carried out to determine severity of ferroresonance and to obtain information for use in the development of a device which would protect the capacitor during this condition. The subject was studied theoretically, using an electronic computer, and practically, using full-size transformer–capacitor combinations with controlled initial conditions. It was found that ferroresonance is likely to occur if more than about 1.5% capacitor compensation is used; recommendations for suppression of the condition or protection against it are made. M.R.Dickson

621.316.99

702 EARTHING PRACTICE, INSTALLATIONS AND ELECTRODES. J.Mellanby.
Elect. Rev., Vol. 166, No. 1, 15-17 (Jan. 1, 1960).

A discussion of the general types of earthing installations, including protective multiple earthing, for protection against shock, fire and lightning is followed by a description of various forms of earth electrodes. Brief mention is also made of the use of earth leakage circuit-breakers.

621.316.99

703 AUTOMATIC INDICATION OF GROUND CONNECTIONS OF OUT-DOOR HIGH-VOLTAGE NETWORKS. J.Heral.
Elektrotech.Obzor, Vol.48, No.8, 415-23 (1959). In Czech.

A relay indicator of the number of ground connections in a system of grounds and of faulty lines is described. The apparatus is suitable for networks protected by extinction coils. Application of the indicators is shown by practical examples. N.Klein

621.316.99

704 THE EXTENDED CONDUCTOR IN AN ELECTRIC FIELD. K.Sailer.

Österr. Z. ElektWirtsch. (Ö.Z.E.), Vol. 12, No. 7, 385-9 (July, 1959). In German.

Test results are given of the potential distribution about the earthing arrangement of a 220 kV transmission tower. Mathematical solutions are derived for the maximum potential assumed by short and long conductors penetrating a given electric field, thus simulating the conditions to which buried cables or metal pipes are subjected when crossing fields produced by earth fault currents in systems with solidly earthed neutral. The beneficial effect is examined of insulating a length of the conductor from the surrounding soil.

R.H.Golde

621.316.99 : 621.315.211.9

705 GROUNDING AND CATHODIC PROTECTION OF PIPES FOR PIPE-TYPE FEEDERS. F.E.Kulman.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 184-92 (1959) = Pwr Apparatus Syst., No. 42 (June, 1959).

The requirements for earthing the shield of pipe-type cables are explained by considering voltages induced in pipes due to external magnetic fields, lightning surges entering cables, circuit-breaker restriking, and line-to-earth faults. The principle of cathodic protection is explained and methods of meeting the contradictory earthing and cathodic protection requirements are described in some detail. These include (1) the insertion of a d.c. voltage source in series with the earth lead between the pipe and station earth; and (2) the installation of a spark gap or cutout in the earth lead, and the connection of cathodic protection sources at various points along the pipe line.

E.M.Dembinski

TRACTION . DRIVES

621.335.2

706 TRAIN HAULAGE ON LÖTSCHBERG LINE AND DESCRIPTION OF THE Ae 8/8 LOCOMOTIVE. W.Grossmann.

Schweiz. Bauztg., Vol. 77, No. 39, 623-9 (Sept. 24, 1959). In German.

This locomotive, the mechanical and electrical equipment of which is described in detail, was provided to enable trains up to 900 tons to be hauled on the Lötschberg line which has gradients up to 1 : 37. It is composed of two coupled locomotives, based on the type Ae 4/4. Main data: 1-hr rating, 8800 h.p. at 75 km/h; corresponding tractive effort 31 000 kg; max. speed 125 km/hr, weight 160 tons. Results of test runs and service experience are given.

A.Karlsbad

621.336.22

707 ELASTICITY AND DYNAMICS OF CONTACT WIRE AND CURRENT-COLLECTOR. M.Süberkrüb.

Elekt. Bahnen, Vol.30, No.4, 77-85 (April, 1959). In German.

See Abstr. 5892 of 1959. The behaviour of the current-collecting strip under the hard points of the contact wire (suspension clamps, section isolators) is analysed mathematically. The shock impulse under the suspension point, the proper and forced oscillation frequencies of the current-collector (of various designs) and of the contact wire are determined. These data enable an adequate design of the contact line to be made to avoid unnecessary wear.

A.Karlsbad

621.34

708 ELECTRICAL EQUIPMENT FOR AN 18 INCH STRIP AND SKELP MILL DRIVE. P.E.Peck and W.J.Young.

B.T.-H. Activ., Vol. 30, No. 5, 193-204 (Sept. - Oct., 1959).

A description of a continuous 14 stand rectifier mill installed in Newcastle, N.S.W. The rectifier phasing and control arrangements are described in detail together with the method of starting and operational characteristics. An account is given of the layout of the control gear and the methods adopted for ventilation, alarm annunciation, lubrication, hydraulic systems and de-scaling equipment.

M.Rathbone

621.34

709 ELECTRICAL CONTROLS IN THE STEEL INDUSTRY. I. J.C.Christie and J.T.Jones.

Elect. Rev., Vol. 165, No. 15, 681-5 (Nov. 20, 1959).

The control requirements of hot primary reversing mills are considered and methods of application outlined. Reference is made to the use of magnetic amplifiers in control circuits and to mercury-arc rectifiers as an alternative to ligner sets. The requirements for auxiliary drives in primary mills are also briefly outlined.

M.Rathbone

621.34

710 ELECTRIC COMPRESSION DISTILLERS. S.B.Jackson.

Elect. Times, Vol.136, 693-5 (Dec. 10, 1959).

The electrical characteristics of vapour compression distillers are discussed with particular reference to the load on the power system. A new type of compressor of adiabatic efficiency is described, which reduces the specific power consumption per pound of water distilled by about 40-50% as compared with former models. Factors affecting cost, off-peak distillate economies, and applications in industry are considered.

Central Electricity Generating Board Digest

621.34

711 ELECTRICAL EQUIPMENT FOR COAL PREPARATION PLANTS. F.Egerton and W.H.Foster.

Mining elect. mech. Engr, Vol.40, 84-95 (Oct., 1959).

A brief description of the operating principles of coal washeries is followed by an account of the types of machines used, the arrangements for starting and special circumstances which determine the provision of sequenced interlocking and control stations. Reference is made to network design principles, lighting, heating and communication facilities. Typical layouts are illustrated.

M.Rathbone

621.34

712 THE ELECTRIC DRIVE OF CRANES. M.Bizot.

Tech. mod., Vol. 51, No. 7, 9-18 (July, 1959). In French.

A review of present practice with regard to heavy-duty cranes, especially for loading and unloading at ports, and limited to drives by 3-ph. induction motors. Requirements for raising, lowering and horizontal travel are described. Methods of braking are compared: reverse current; d.c. excitation; single-phase; frequency changing; pole-changing. The action of the grab crane is explained. Swinging of the load and adhesion of wheels are considered. The gantry crane with an electric shaft is discussed and a control cabin is described.

R.G.Jakeman

INSULATING MATERIALS DIELECTRICS

621.315.613.1

713 THE INFLUENCE OF MICA THICKNESS ON ITS ELECTRICAL RESISTIVITY. B.N.Tardov.

Radiotekhnika, Vol. 14, No. 8, 51 (Aug., 1959). In Russian.

The resistivity is measured in the direction normal to the surface of perfect contact between layers (001). The formula ρd^a = const was previously used with a = 1. It has now been found experimentally that a = 2.5. The formula to reduce ρ to standard resistivity ρ_{st} for thickness d = 25 μ is given. The conditions for correct evaluation of ρ are enumerated. The dependence of ρ on d for mica and other dielectrics may explain the appearance of a counter e.m.f. due to polarization, which is lower for thickness regions of the specimen.

M.W.Makowski

621.315.616

714 ORGANIC INSULATING MATERIALS IN LIGHT-CURRENT ELECTRICAL ENGINEERING FOR THE TROPICS. J.Šedovič.

Slaboproudy Obzor, Vol. 20, No. 8, 486-9 (1959). In Slovak.

The following types of the Czechoslovak-made materials, suitable for tropicalized equipment, are reviewed: (1) pressed materials (novals, bakelites); (2) laminates; (3) plastics (p.v.c., polystyrene, teflex, styroflex etc.); (4) plastic foils (styroflex, teflex, triafols etc.); and (5) impregnating varnishes. Physical and electrical properties of the materials are indicated in five tables.

R.S.Sidorowicz

621.315.617

715 IMPREGNATION BY MEANS OF WAXES, COMPOUNDS AND VARNISHES. J.Kocian.

Slaboproudy Obzor, Vol. 20, No. 8, 490-5 (1959). In Czech.

Impregnation aims at the protection of electrical components against tropical atmospheric conditions and improvement of mechanical strength. Impregnating coatings can be formed by physical, physical–chemical or chemical means. In the first case, impregnation is based on materials which solidify in normal ambient temperatures. Physical-chemical impregnation is carried out with varnishes which contain drying oils. Chemical impregnation is based on the use of potting resins and synthetic varnishes. Actual impregnation consists of three operations: drying of components to be impregnated, dipping in the impregnating substance and final treatment (cooling, drying). Two tables indicating composition and electrical properties of a large number of impregnating waxes, tars and compounds, and insulating varnishes are given.

R.S.Sidorowicz

621.315.618

716 FACTORS CONTROLLING ELECTRIC STRENGTH OF GASEOUS INSULATION.

P.Narbut, D.Berg, C.N.Works and T.W.Dakin.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 545-51 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

A general review of problems concerning electrical insulation systems using gases, particularly those with electronegative properties. Breakdown field strengths and time lags are dealt with and a discussion of non-uniform field breakdown (including factors affecting corona onset) is given.

J.D.Craggs

621.315.619

717 ELECTRICAL AND MECHANICAL PROPERTIES OF GLASS–EPOXY LAMINATES. L.Blumental.

Bull. Soc. Franc. Elect., Vol. 9, 525-32 (Sept., 1959). In French.

Describes the manufacture of sheets and rods of this material. Details are given of mechanical and electrical properties together with examples of typical applications in insulators and switchgear.

MEASURING METHODS
ELECTRICAL TESTING

621.317.2

718 A NEW ELECTRICAL RESEARCH LABORATORY. F.E.Andrews and A.Vitkus.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 489-98 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

The laboratory is intended for research, development and design of electric apparatus, hardware and other products for electrical utility transmission and distribution systems and for wire communication systems. The layout of the plant is illustrated and the procedure for a.c. testing is described. The design of the surge generators is indicated, the high-voltage unit having a max. voltage rating of 3150 kV and the high-current unit a max. output of 300 kA crest. A discussion is added.

R.G.Jakeman

621.317.32 : 621.389

719 NEW TECHNIQUES IN PHYSIOLOGICAL RECORDING UNDER DYNAMIC CONDITIONS. H.M.Hanish.

I.R.E.WESCON Convention Record, Vol.3, Pt 8, 20-5 (1959).

The problem of design of skin electrodes for measurements of e.c.g., e.e.g. or e.m.g. voltages over periods of days or weeks is discussed and a pattern employing a miniature sponge sealed to the skin in a cover, into which an electrolyte is injected meets the requirements best. The voltages are passed through frequency-selective circuits so that the same leads can be used for two or more purposes, the frequency range required for e.c.g. recording being 0.5 to 20 c/s and for e.m.g. above 50 c/s. The electrodes are used with a small preamplifier weighing less than 1 oz attached to the body.

F.T.Farmer

621.317.33

720 MEASUREMENT OF IMPEDANCE IN THE AUDIO-FREQUENCY RANGE. D.Karo.

Engineer, Vol. 208, 687-90 (Nov. 27, 1959).

Mainly because of the effect of residuals in the standard resistors, the number of bridge circuits that are really precision methods of measuring impedance is very limited. This article describes a novel bridge circuit in which the number of resistance standards is reduced to the barest minimum and the effect of the remaining residuals is eliminated by a double balance. One standard resistance is used for the setting of the bridge, and this is the only one in the circuit which would have a small residual.

621.317.331

721 ELECTROMETER MEASUREMENTS OF VERY LOW ION DENSITIES IN GASES.

R.L.Ramey and R.L.Overstreet.

I.R.E. Trans Instrumentation, Vol. I-8, No. 2, 46-51 (Sept., 1959).

Use of a vacuum tube electrometer to measure electric current as low as 6×10^{-19} A arising from the relative motion existing between a probe and an ion-bearing gas is described. The measurement techniques are applicable to most gases at ambient pressures ranging from many atmospheres down below 10^{-7} mm Hg, provided that high-vacuum practices are observed. Ion densities as low as 10 ions/mm^3 at standard conditions and flow rates of 5 to 10 mm^3/s at standard conditions are used. The problems of balancing the electrometer to compensate for background, available measurement time, and probe selection are considered.

621.317.2

722 CLIMATIC TEST METHODS IN ELECTRICAL ENGINEERING. B.Bartáková.

Slaboproudy Obzor, Vol. 20, No. 8, 506-9 (1959). In Czech.

The actual climatic conditions, under which a given piece of equipment is to operate, can be approximated in a laboratory. However, it is quite difficult to find an exact correlation between the actual and the laboratory conditions, especially if accelerated test conditions are employed. The laboratory testing is carried out in special "tropical chambers", where the temperature can be raised to 55°C. While a component is in the chamber, its electrical characteristics are recorded either continuously or at fixed time intervals. The following tests can be carried out: (1) long-term dry-heat test; (2) periodically repeated dry-heat cycles; (3) continuous humid heat test; and (4) repetitive humid heat tests. The last of the tests appears to be the most informative.

R.S.Sidorowicz

621.317.331

723 METHODS OF MEASURING ELECTRICAL CONDUCTIVITY. S.F.Kozlovskii.

Pribory i Tekh. Eksper., 1959, No. 3, 110-13 (May-June). In Russian.

The rotating magnetic-field method is investigated for powders. The sensitivity is increased by two orders by making the period equal to the natural period of oscillation of the suspended system. For a grain size 1 mm at least 0.1 cm^3 are required for a substance of resistivity ~ 10^{-5} ohm cm, suspended by a 58μ diameter tungsten thread 400 mm long, using a 90 Oe field at 50 c/s. For 0.1 mm grains the minimum volume is 10 cm^3.

R.Berman

621.317.333.4

724 IMPROVED D.-C. HIGH-POTENTIAL TESTING OF INSULATION SYSTEMS IN LOW- AND MEDIUM-VOLTAGE D.-C. EQUIPMENT. A.M.Odok and T.M.Soelaiman.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 186-99 (1959) = Applic. and Industr., No. 44 (Sept., 1959).

Elimination of unexpected breakdowns in d.c. high-potential testing is made possibly by observing the electrical noise caused by ionization. (The terms ionization and ionization discharges are used as common terminology to refer to charge redistributions as a result of gaseous breakdowns in the insulation systems. However, it is more appropriate for the purposes of the paper to include in this term the charge redistributions taking place whenever a minute conducting path on the insulation surface is broken down.) The relative severity of ionization discharges is easily detected by picking up a voltage drop proportional to the current in the test circuit. The high-frequency discharges can then be observed on an oscilloscope screen or measured by other means. It is found that: (1) d.c. high-potential tests are nondestructive if they are stopped at the voltage value at which any appreciable amount of ionization is observed, because breakdown is always preceded by ionization discharges in the insulation system; (2) the noise pattern on the oscilloscope screen is different for different conditions of insulation. This, in conjunction with the leakage- and absorption-current characteristics, enables one to tell whether the insulation is dry or

wet, clean or dirty. Tests have been made on small laboratory samples of insulation; on components of railroad equipment, such as armatures and field windings; and on entire locomotive power circuits. A great number of tests were carried out without any unanticipated breakdowns occurring.

621.317.333.42

725 EXPERIMENTAL FAULT-LOCATING WORK ON PIPE-TYPE CABLE.

H.L.Garton, C.Jasper, E.J.Steeve and H.R.Winemiller.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 821-29 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

Conventional locating methods were studied and were decided to be inadequate to meet many of the fault conditions which may occur on pipe-type cable. Ideas for new methods to supplement existing ones were developed. Tests were made by various means, attempting to approximate the behaviour of a fault. Finally, in order to make tests under near actual operating conditions, a fault was built into each of two conductors of a newly constructed, 12-mile 138 kV oil-filled pipe-type cable line. Sufficient information was obtained to assure a quick, accurate location of any type of fault. Some additional developmental work may be required to explore the full potentialities of some of the new fault-locating methods.

621.317.333.8

726 PULSE AND OSCILLOGRAPHIC TECHNIQUES FOR MEASURING DISCHARGE DELAYS IN DIELECTRICS.

A.A.Vorob'ev, G.A.Vorob'ev, G.A.Mesyats and K.K.Sonchik.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1257-9 (Aug., 1959). In Russian.

Describes circuits for generating and recording h.v. rectangular pulses with a front length of 2 to 3 × 10^{-8} s (or 10^{-9} s) with hard synchronization of the time scan with the phenomenon studied. Applications are suggested. D.E.Brown

621.317.34

727 UNCONVENTIONAL TECHNIQUE FOR MEASURING V.S.W.R. J Hanson.
Electronics, Vol. 32, No. 43, 120-1 (Oct. 23, 1959).

Describes the reflectometer method for measuring the v.s.w.r. of an aerial in the 150–175 Mc/s band. The equipment, including the signal source, is completely transistorized, and the reflectometer consists of a simple bridge RC network. The accuracy is 10% for values of the v.s.w.r. from 1 to 5 and 20% from 5 to 10.
E.A.Ash

621.317.34

728 NOISE MEASUREMENT OF NEGATIVE RESISTANCE AMPLIFIERS. A.Brodzinsky and A.C.Macpherson.
I.R.E. Trans Instrumentation, Vol. I-8, No. 2, 44-6 (Sept., 1959).

Using the extended definition of noise figure of Haus and Adler (Abstr. 5163 of 1957), a modified procedure is described which employs an auxiliary passive dissipative network following the negative resistance device to transform the real part of the output impedance to a positive value. Measurement and computational steps are outlined and calculations are carried out for three specific networks covering l.f. and microwave regions. It is also shown that, under certain conditions, the use of a passive dissipative network at very low temperature results in an over-all figure (for a cascade containing negative resistance devices) which approaches that of the first stage.

621.317.37

729 GRAPHS OF THE COMPLEX HYPERBOLIC FUNCTION $\frac{\text{th}Te^{\gamma\tau}}{Te^{\gamma\tau}}$ APPLIED TO THE DETERMINATION OF DIELECTRIC CONSTANTS AT HIGH FREQUENCIES.

Madeleine Felden and Marceau Felden.
Onde elect., Vol. 39, 754-6 (Sept., 1959). In French.

Complex dielectric constants can be determined by measuring the input impedance of a section of waveguide containing the dielectric sample and closed by a metal short-circuiting plate. Determination of the real and imaginary parts of the permittivity requires the solution of the equation $Ce^{j\psi} = \frac{\text{th}(Te^{\gamma\tau})}{Te^{\gamma\tau}}$. Graphs are given which enable this solution to be found over a wide range of values of the parameters involved. G.D.Sims

621.317.37 : 621.313.32

730 THE MEASUREMENT OF THE TORQUE-ANGLE IN SYNCHRONOUS MACHINES. C.Benco.
Tecn. Ital., Vol. 24, No. 6, 475-80 (Sept., 1959). In Italian.

An electronic method is described. The principal item is a vane, mounted on the coupling between the alternator and the driving motor, which periodically interrupts the light from a lamp to a photo-cell. An arc of a circle is produced on the c.r.o. screen and the position of the beginning of this arc gives a direct reading of the torque-angle. The circuit is fully described. Test results are given and a bibliography with 20 refs. is added. R.G.Jakeman

621.317.38 : 621.313.333

DYNAMIC MEASUREMENT OF TORQUE CHARACTERISTIC OF INDUCTION MOTORS. See Abstr. 655

621.317.374

731 ON THE EVALUATION OF RESULTS OF THE MEASUREMENTS OF THE TANGENT OF THE LOSS ANGLE.

M.Rúkoš.
Elektrotech. Obzor, Vol. 48, No. 9, 482-5 (1959). In Slovak.

When the loss angle of a capacitor is measured an air capacitor of known capacitance is frequently connected in parallel with it. A relation is derived for the calculation of the loss angle of the tested capacitor and graphs are given for quick calculations. Results of experiments and calculations are given. N.Klein

621.317.39

732 INDUCTIVE TRANSDUCER OF IMPROVED SENSITIVITY FOR REGISTRATION OF LINEAR AND ANGULAR MOVEMENTS. A.S.Sadovskii.
Avtomat. i. Telemekh., Vol. 18, No. 9, 802-13 (1957). In Russian.

A geared straight-through inductive transducer is considered, with sensitivity higher than that of solid-armature types, which can measure the movements and register equal and unequal intervals along any desired length. It can be cylindrical, and the transmission is in the form of rings or a screw thread. The latter type may be used for measurements of angular movements. Such measuring devices are applied to precision boring machines with co-ordinate systems and to establish an automatic and pre-arranged co-ordinate method, which can not be done optically. Separate sections of the article are devoted to: (1) geared transducer which can be produced in small sizes and sufficiently sensitive; (2) a gear profile, guaranteeing absence of erroneous zero pulses; (3) transducer with screw-threaded armature and registering, for the second time, small equal intervals; and (4) transducers with screw armature for measurement of angular movements. Z.Koprowski

621.317.39

733 AN EQUIPMENT FOR MEASUREMENT OF TOOL CUTTING FORCES. J.Goldberg.
Electronic Engng, Vol. 31, 726-32 (Dec., 1959).

Describes equipment developed for the sequential measurement of components of cutting force on lathe tools during machining operations. The force sensing elements are wire resistance strain gauges used in conjunction with a two-component force dynamometer. The measuring circuits are formed from transformers with inductively coupled windings of 1 : 1 ratio supplying sets of gauges suitably connected. Each component of force is measured by a separate bridge circuit, the input and output circuit of each bridge being switched in the required sequence between a single a.c. driving source and a common detector. By this means the effect of switch contact resistance on the accuracy of the measuring loop is rendered insignificant. Phase-sensitive detection is employed for observing the change in the resistive component of unbalance of the bridges, as well as the sign of the strain. The display system is a pen recorder which incorporates a device for raising and lowering the pen in order to share the recording time between the number of channels in use. Full-scale readings corresponding to forces of 200 lb, 500 lb, and 1 000 lb, are provided, and the equipment can be readily calibrated by static loading. Records of cutting force obtained with the equipment are shown.

621.317.39

734 MEASURING, CLASSIFYING AND COUNTING WHEEL LOADS OF MOVING VEHICLES.

J.J.Trott and P.J.Williamson.
Engineer, Vol. 208, 859-62 (Dec. 25, 1959).

An apparatus has been developed which automatically weighs

vehicles as they move along the road at normal speeds and counts the number of wheel loads in predetermined weight groups. The equipment consists of a weighbridge installed in the road and supported on four load cells. The strains produced in the load cells by a vehicle crossing the weighbridge are measured by resistance strain gauges, the output of which is fed to a reflecting galvanometer. The deflection of the galvanometer is proportional to the load applied to the weighbridge. The optical system of the galvanometer is so arranged that it can be used to classify the loads.

621.317.39

735 AUTOMATION OF SINGLE-AXIS FLOATED-GYRO DRIFT MEASUREMENT. J.G.Nelson.

I.R.E. Trans Prodn Tech., No. PGPT-5, 51-5 (Aug., 1959).

Describes the technique and equipment developed for automating measurement of the drift rate of precision single-axis floated gyros. The basic construction principles of single-axis floated gyros are described and illustrated. The sources and components of drift are then discussed and defined. The random component of drift is shown to be a useful measure of gyro quality and is, by reason of its definition, suited to automatic testing techniques. The equipment consists basically of a single-axis servo table (in which the gyro to be tested is mounted), the servo table and gyro operating circuitry, and the programming and readout devices. Although adaptable to a variety of situations, the equipment is designed specifically to apply the "cogging" or repositioning type of single-axis gyro-drift test. The servo table is slaved to the gyro output so that the table angular rate is equal to gyro input plus gyro total drift.

621.317.39

736 A TEMPERATURE MONITORING SYSTEM FOR NUCLEAR REACTORS. R.L.G.Gilbert.

Instrum. Pract., Vol. 13, No. 12, 1235-8 (Dec., 1959).

621.317.39 : 531.788 : 533.5

737 PRINCIPLE OF A SEMICONDUCTOR MANOMETER IN THE PRESSURE RANGE OF 1 TO 10^{-6} mm Hg.

M.Varicak and B.Saftic.

Rev. sci. Instrum., Vol. 30, No. 10, 891-5 (Oct., 1959).

Experiments investigating the use of semiconductors for low-pressure measurements proved that thermistors give the best results. These experiments led to the construction of thermistor systems consisting of miniature thermistors fixed to thin metal foils. With these systems it is possible to measure pressure changes in the range of 1 to 10^{-6} mm Hg. The problem of temperature compensation is discussed and it is shown that in the case of thermistors this problem may be resolved by means of the voltage v current characteristics. A detailed description of the apparatus, including the gauge head as well as the electric circuit and the calibration curves, is given.

621.317.39

738 ELECTRONIC DISTANCE MEASUREMENT IN GEODESY. E.Bergstrand.

Tekn. T., Vol. 89, No. 35, 911-17 (Sept. 25, 1959). In Swedish.

Electronic distance measurement is based on the determination of the time for electromagnetic waves to cover the path in question. The use of Shoran, using 3 radio stations (two on ground and one in an aircraft) and the more recent Hiran (high-precision Shoran) for distances of 200-500 km is explained. The Geodimeter, invented by the author, is described in detail. It is used for distances up to 40 km. A light beam of sinusoidally varying intensity is used. It is modulated by means of a 10 Mc/s radio transmitter feeding a Kerr cell. The beam is aimed at a reflector and on its return the variation of intensity with respect to phase is compared with that of the outgoing beam. The phase is expressed simultaneously with time in angular measure, phase comparison being achieved by photoelectric conversion of the reflected wave. The Tellurometer, based on the same principle as the Geodimeter, but using a radar instead of a light beam is then explained. It is useful in conditions of poor visibility. Characteristics, including accuracy, of all four systems are compared. G.N.J.Beck

621.317.41

739 MAGNETIC MEASUREMENTS WITH BRIDGED-T NETWORK. J.K.Choudhury and P.C.Sen.

Electronic Radio Engr, Vol. 36, No. 11, 422-6 (Nov., 1959).

The authors have described (see Abstr. 4054 of 1958) how the bridged-T network can be very usefully employed for the measurement of magnetic loss and a.c. permeability under different conditions of excitations in the core. The different types of tests include the measurement of: (1) magnetic loss with varying flux density at fixed frequency; (2) a.c. permeability with varying flux density at fixed frequency; (3) magnetic loss and incremental permeability with superposed direct and alternating flux in the core; and (4) a.c. permeability with varying frequency at fixed flux density in the core. A modified circuit has been developed for measurements of the incremental core loss and permeability with superposed direct and alternating flux in the core. It has been shown that the bridged-T network offers several distinct advantages over prevalent bridge arrangements used for magnetic measurements.

621.317.42

740 MAGNETIC FLUXMETER PROBES. B.Ancker-Johnson.

Rev. sci. Instrum., Vol. 30, No. 6, 492-4 (June, 1959).

Constructional details of transmission-line paramagnetic-resonance probes for transverse and axial fields are given. The probe for transverse fields is less than 0.05 in. thick.

A.J.Manuel

621.317.44 : 621.313.1

741 USE OF HALL PROBES FOR THE INVESTIGATION OF THE MAGNETIC FIELD IN THE AIR GAP OF ROTATING ELECTRICAL MACHINES. L.Cesnak and K.Měřínský.

Elektrotech. Obzor, Vol. 48, No. 9, 485-9 (1959). In Slovak.

The field of a 220 V, 72 A, 650 r.p.m. d.c. machine is measured by attaching an InSb probe to a tooth of the rotor, the leads of the probe being connected to specially fixed slip-rings with silvergraphite brushes. Another probe is attached to a main pole-face. Oscillographic records and point by point measurements with the probes show good agreement. Comparison with records obtained with the help of coils show that the latter give a less accurate picture owing to the larger size of the coils. Records obtained with the probes give only comparative data, owing to the large temperature coefficient of the InSb probe and it is thought that InAs might be more suitable for probes. N.Klein

621.317.44 : 621.318.13

742 MEASUREMENT OF FERRITE CONSTANTS BY [MEANS OF] RECTANGULAR CAVITY RESONATOR. F.Okada.

J.Inst. Elect. Commun. Engrs Japan, Vol.42, No.8, 758-64 (Aug., 1959). In Japanese.

Describes a method of determining the tensor permeability $[\mu]$ and the dielectric constant ϵ of ferrite samples from the variations of the resonance frequency and Q factor of $TE_{101,011}$ and $TM_{120,210}$ rectangular degenerate cavity resonators due to the introduction of the samples. The quantities μ_g and ϵ can all be measured by changing the position of the test piece in the resonator. Thin disks, small spheres and thin rods were used in tests at 7 kMc/s on CuMgAl ferrites, the $TE_{101,011}$ resonator being utilized for the disk and sphere samples, and the $TM_{120,210}$ resonator for the rod samples. The results obtained are shown graphically. The measurement formulae are derived from perturbation theory and are suitable for evaluating observational errors due to lack of symmetry in the location of the test piece inside the resonator. The experimental results are in good agreement with Bloembergen's resonance theory. A.Wilkinson

621.317.6 : 537.32 : 539.2

743 CONCERNING THE MEASUREMENT OF THE THERMOELECTRIC PROPERTIES OF SEMICONDUCTORS. M.A.Kaganov, I.S.Lisker and I.G.Mushkin.

Fiz. tverdogo Tela, Vol. 1, No. 6, 988-90 (June, 1959). In Russian.

The method proposed by Harman (Abstr. 1492A of 1959; J. appl. Phys., Vol. 29, No. 9, 1373-4 (1958)), for the measurement of the parameter $z = \alpha^2\sigma/\chi$ of semiconductors is discussed (α is the thermoelectric power, σ the electrical conductivity, and χ the thermal conductivity), and a correction factor due to heat emission from the specimen and the lead wires is introduced. It is shown both theoretically and experimentally that this factor is independent of the current used. The value of the correction factor is estimated to be 1-2% and 4% for a Bi–Te–Se alloy specimen 1 cm by 0.25 cm^2 measured in vacuum and still air respectively. D.J.Huntley

INSTRUMENTS
MEASURING APPARATUS

621.317.733

744 ORTHONULL — A MECHANICAL DEVICE TO IMPROVE BRIDGE BALANCE CONVERGENCE.
H.P.Hall.
Gen. Radio Exper., Vol. 33, No. 4, 7-12 (April, 1959).

The L-Q form of the Maxwell inductance bridge uses resistors as the two variable elements of the bridge. It has the disadvantage that when components of low Q value (e.g. 0.5) are being measured, the rate of balance convergence is slow: the finite resolution of the Q-dial variable resistor adds to the balancing difficulty. It is shown that rapid convergence is obtained by a unilateral mechanical ganging of the two dials so that when the L-dial resistor is adjusted the Q-dial resistor follows, and a constant ratio between the two resistors is maintained. The coupling is mechanically inoperative when the Q-dial is being adjusted. The mechanism consists of two pulleys on the dial resistor spindles coupled by a cord, with a releasable friction clutch. The clutch is disengaged when components which give a satisfactory rate of balance convergence are being measured. The basic bridge accuracy is not affected since the device only affects the manner in which the balance is made. C.F.Pizzey

621.317.733 : 537.7

745 ACCURATE HIGH-SPEED VOLTAGE COMPARATOR.
D.S.Robertson, B.F.Wadsworth and S.E.Brown.
Rev. sci. Instrum., Vol. 30, No. 10, 896-8 (Oct., 1959).

A new high-speed voltage comparator using a silicon capacitor bridge is described. For an input signal with a rate of change of 300 V/sec, the resolution is better than 1 mV. The performance of the circuit is discussed and results are given.

621.317.755

746 THE NEW MARCONI GENERAL PURPOSE OSCILLOSCOPE TYPE TF 1330.
L.D.Kreps, D.C.Jones, J.J.Julian and J.K.Moore.
Marconi Instrum, Vol.7, No.2, 37-48 (June, 1959).

An outline is given of the general requirements of this type of oscilloscope which are becoming increasingly difficult to meet due to their conflicting nature. A description of the TF 1330 gives an idea of the kind of design problems encountered and their solutions. Of particular interest is the Miller-bootstrap circuit employed in the horizontal deflection sweep generator to give a very wide range of sweep speeds and good linearity. An abridged specification is appended and a block diagram shown. J.W.Lee

621.317.76

747 BROAD-BAND RADIO FREQUENCY INTERFEROMETER.
J.W.Carr.
I.R.E. Trans Instrumentation, Vol. I-8, No. 2, 39-43 (Sept., 1959).

In a steady-state monochromatic interferometer the interference pattern is scanned by the detector and the absolute wavelength thus determined. In the system described here the interference pattern sweeps past stationary detectors in a manner which is related to the change in frequency. Thus when the total net change in the phase of the interference pattern is measured with respect to a given absolute reference, an absolute measure of frequency can be obtained. The band being scanned is divided into an arbitrarily large number of unit cells determined by the required resolution. Pulse forming networks and logic circuits deliver the information in a manner readily adaptable to a binary counting system and substantially independent of the rate of change of r.f. frequency and signal amplitudes.

621.317.785

748 THE WORKING LIFE OF A METER. I - II.
J.L.Ferns.
Elect. Times, Vol. 136, 461-4 (Oct. 29); 502-4 (Nov. 5,1959).

Part I deals with off-circuit testing, meter records and the fixing of meters. Part II considers meter changing, interference with meters or cutout and complaints concerning meter readings.
Central Electricity Generating Board Digest

621.317.79 : 621.389

749 A PROGRAMMED TEST SET.
D.W.Bradfield, A.M.East, and H.F.Rourke.
Electronic Engng, Vol. 31, 714-21 (Dec., 1959).

Describes how, by programming the test sequence with uni-selectors, complex electronic equipment may be checked in a fraction of the time required to carry out manual tests. The test results are indicated by means of a 'go—no go' display. The particular programme was evolved to test the power system of a guided weapon, but the principles are generally applicable to a wide range of equipment.

621.317.79 : 621.311.25

750 NUCLEAR POWER STATION INSTRUMENTATION.
M.W.Jervis.
Electronic Engng, Vol. 32, 24-9 (Jan., 1960).

The control and protection systems of nuclear reactors include electronic equipment fed from thermocouples and nuclear detectors. Instruments for measurement and protection are reviewed with special reference to safety circuits and automatic data logging. Trends in design of shut-down amplifiers and television equipment are also discussed.

621.317.79

751 TRANSISTORIZED REACTOR INSTRUMENTATION AND PROTECTIVE CIRCUITS. R.R.Hoge and D.J.Niehaus.
I.R.E. Trans Nuclear Sci., Vol. NS-6, No. 2, 42-8 (June, 1959).

Nuclear reactor instrumentation and protection circuits which cover a range of six and one-half decades of reactor power are described. The circuits are designed to provide maximum protection for the reactor while maintaining the ability to prevent unscheduled shutdowns. To accomplish these features, solid-state components and fail-safe designs are employed wherever feasible.

621.317.79

752 BEAM-PROFILE INDICATOR.
H.G.Jackson, D.A.Mack and C.Wiegand.
I.R.E. Trans Nuclear Sci., Vol. NS-6, No. 2, 64-9 (June, 1959).

Describes an instrument for displaying intensity profiles of charged-particle beams that emerge from high-energy accelerators. The intensity v. position on a strip of 21 scintillation counters each 1 by 1 cm appears as a histogram on an oscilloscope. The display is accomplished by employing transistor circuits to amplify and integrate the outputs of the multiplier phototubes. The accumulated charge associated with each counter element is then read out in sequence by means of a blocking-oscillator commutator. The output signal is further amplified logarithmically for oscilloscope deflection.

621.317.79

753 A NEW LUMINANCE AND LUXMETER.
S.Andersson.
Ljuskultur, Vol. 31, No. 3, 159-64 (July-Sept., 1959). In Danish.

The meter is based on a CdS photoresistance with a $0.8 \times 2.2\ mm^2$ light-sensitive area. The photo-current is shown as a function of illumination. The max. load on the photocell is 15 mW. Temperature dependence is compensated by a negative-temperature-coefficient resistance. To increase speed of response, a supplementary light source in the form of a small glow discharge tube is used, which enables readings to be obtained in 2 sec compared with 15 sec without it. There are five measuring ranges, from 0–3000 cd/cm^2 down to 0-30 cd/m^2. Power supply is from 1.5 V and 30 V batteries.
G.N.J.Beck

621.317.79 : 621.375.123

A COMPENSATION TECHNIQUE FOR REDUCTION OF PERFORMANCE ERRORS OF OPERATIONAL AMPLIFIERS.
See Abstr. 335

621.317.79 : 620.172.222

754 A MULTIPOINT DIGITAL STRAIN-GAUGE RECORDER.
J.R.Sturgeon.
Trans Soc. Instrum. Technol., Vol. 11, No. 4, 213-22 (Dec., 1959).

During static strength tests of an aircraft structure, it is usual to take readings from a number of strain gauges distributed over the test specimen. Simultaneous measurement is not necessary, and therefore the most economical design is a recorder and multipoint selector switch. The long conductors to the recorder, however, introduce problems due to conductor resistance and mains interference at harmonics of the mains frequency. An instrument is described in which a selector switch, coupled to a recorder, enables a set of 216 readings to be taken in less than two minutes. The selector switch is designed to reduce errors due to conductor resistance and mains interference. The recorder switches fixed resistors in a strain-gauge bridge until a null balance is obtained for each gauge point, and transfers the corresponding number to punched cards.

The scale is 0 to 8665 units, representing 4½% change in resistance of the active strain gauge; the long scale-length eliminates the need to balance the strain gauges before measurement. The recorder uses a galvanometer amplifier and is insensitive to signals of frequencies higher than 10 c/s.

MAGNETIC DEVICES AND MATERIALS

621.318.13

755 A HIGH-SPEED FERRITE STORAGE SYSTEM. C.J.Quartly.

Electronic Engng, Vol. 31, 756-8 (Dec., 1959).

A square loop ferrite storage system is described which overcomes the limitation on speed imposed by the core material when used in a conventional store using coincident drive selection. Each digit is stored as a difference in flux levels in two cores which are only partially switched during the writing operation. Measurements made on a pair of cores show how the output during reading varies with write pulse duration and amplitude and with digit pulse amplitude. The use of this principle with external word selection enables a read–write cycle time of 0.5 μsec to be achieved in a small store.

621.318.13

756 COMPACT MEMORIES HAVE FLEXIBLE CAPACITIES. D.Haagens.

Electronics, Vol. 32, No. 40, 50-3 (Oct. 2, 1959).

A coincident-current store using Ferramic cores is designed so that its capacity can be increased up to 8192 bits; the first unit has a capacity of 144 × 4 bits. Random or sequential access can be arranged, the operation time is 10 μs and the ambient temperature may range from 0° to 50°C. The drive transformers are arranged in a matrix and each has one output winding and two input windings, one for each direction of drive. Transistors are used to feed the transformers, and a separate circuit allows the whole store to be cleared in one operation. Circuit diagrams are given of the drive amplifiers and also of the sensing amplifier, all of which are transistorized. G.A.Montgomerie

621.318.13 : 621.374.32

757 THIN-FILM MEMORIES. E.E.Bittmann.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 92-7 (June, 1959).

A small random-access memory using deposited magnetic thin films as storage elements, and with a cycle time of 1μs, is described. Information is read from or written into the memory by linear or word selection techniques. The addressing, driving and sensing circuits are transistorized. The deposited thin films are 2000 A thick, switch in 0.1 μs and generate a 5 mV output signal in the sense winding. A sense signal is obtained of opposite polarity from a selected element when a "1" or a "0" is read out. A memory-plane wiring configuration has been selected which is least susceptible to noise.

621.318.13 : 621.374.32 : 681.142

758 BIBLIOGRAPHY OF DIGITAL MAGNETIC CIRCUITS AND MATERIALS. W.L.Morgan.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 148-58 (June, 1959).

This bibliography of about 400 references is divided into 19 sections. Several sections are devoted to the physical, magnetic, and switching parameters of magnetic materials. Other parts cover the circuit and logical aspects of using magnetic cores, plates, "twistors", thin films, and transfluxors. Attention is given to the use of special memory techniques such as domain wall viscosity readout, cross-field effects, and circuits operated with r.f. carriers. The use of magnetic cores as half adders, gates, and shift registers is recognized in a separate section. A listing of sources of further information (conference proceedings, books, and other bibliographies) is included.

621.318.381 : 621.316.721

A SIMPLE CURRENT STABILIZER FOR ELECTROMAGNETS.

See Abstr. 689

621.318.2 : 538.2 : 539.2

759 THERMOMAGNETIC GENERATOR. J.F.Elliott.

J. appl. Phys., Vol. 30, No. 11, 1774-7 (Nov., 1959).

Calculations are made for the power output and the efficiency of energy conversion of a thermomagnetic generator. Particular attention is paid to the use of the ferromagnetic element gadolinium as a suggested material for a practical device for the generation of electrical power from a low grade heat source (i.e. in the neighbourhood of 20° C).

INDUCTORS . REACTORS RELAYS

621.318.435

760 ANALYSIS OF SERIES-CONNECTED SATURABLE REACTOR WITH CAPACITIVE LOADING AND FINITE CONTROL RESISTANCE BY USE OF DIFFERENCE EQUATIONS. H.C.Bourne and J.T.Salihi.

Trans Amer. Inst. Elect. Engrs I, Vol. 78, 461-71 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

A series-connected saturable reactor with capacitive loading exhibits interesting features. The circuit may exhibit instability associated with a double or three-valued output corresponding to a given input depending on previous history of operation. In some ranges of circuit parameters and forcing function, the circuit may become regenerative thus oscillating at a low frequency modulating the carrier. A brief survey of the different phenomena occurring in the circuit is given, followed by a thorough analysis of the oscillatory feature of the circuit. Assuming a rectangular forcing function, the critical conditions for oscillation and the frequencies at which the circuit oscillates are derived. Since a saturable reactor essentially responds to the half-cycle average input, it may be expected that the theoretical results obtained for the case of a rectangular forcing function predict approximately the behaviour of the circuit for the case of sinusoidal excitations. A comparison of measured results obtained from a circuit excited by a sinusoidal voltage with the theoretical results show good correlation.

621.318.5

761 TWO ECONOMICAL CIRCUITS FOR HIGH-SPEED CHECKING OF CONTACT CLOSURES. K.Enslein.

I.R.E. Trans Instrumentation, Vol. I-8, No. 2, 51-5 (Sept., 1959).

Describes circuits for checking whether the contacts have operated properly or not. The circuits described are faster than relay checking systems, yet they are not as fast as the microsecond units used in computers. The check is made by examining the contacts one at a time, and counting the contact closures.

621.318.562.7

762 ELECTRONIC TIME RELAY WITH A PULSE CHARGED CAPACITOR. P.Yu.Kanevskii.

Priborostroenie, 1959, No.5, 7-8 (May). In Russian. English translation in : Instrum. Constr., 1959, 7-8 (May):

The relay described gives a delay of up to 10 min with 0.3% accuracy. A generator rotates a cam disk which operates a switch so that pulses of length t_u = 0.3 sec and amplitude U_e = 250 V are fed to a capacitor. When the voltage across the capacitor reaches 105 V a voltage stabilizer starts to conduct and operates a relay. The relay becomes self-locked, the generator supply is cut off and the regulating contacts make. When the unit is switched off the circuit discharging the capacitor is connected and the apparatus is prepared for the next operation. A resistor is used for accurate setting of the delay time and to eliminate the influence of leakage resistance a further resistor is included. The basic circuit diagram is given together with relative theory and calculation. H.A.Miller

ELECTROSTATICS . CAPACITORS

621.319.4 : 621.382.23

763 VARIABLE CAPACITANCE WITH LARGE CAPACITY CHANGE. J.L.Moll.

I.R.E.WESCON Convention Record, Vol.3, Pt 3, 32-6 (1959).

The capacitor described is an improved version of the Si crystal diode which utilizes the variation in barrier thickness with voltage to achieve a voltage-controlled capacitance. In the present construction a thin film of oxide is created on the surface of n-type silicon and a small counterelectrode evaporated on to the oxide. As a result a higher capacitance is achieved at low voltage while the capacitance at high reverse voltages is unchanged. The range is thus increased. K.W.Plessner

621.319.42

764 SOME RESULTS ON THE CROSS-CAPACITANCES PER UNIT LENGTH OF CYLINDRICAL THREE-TERMINAL CAPACITORS WITH THIN DIELECTRIC FILMS ON THEIR ELECTRODES. D.G.Lampard and R.D.Cutkosky.

Proc. Instn. Elect. Engrs, Monogr. 351M, publ. Jan., 1960, 8 pp. To be republished in Part C.

The effect on the cross-capacitances per unit length of cylindrical 3-terminal capacitors of thin dielectric films on the capacitor electrodes is discussed. It is assumed that the cross-section of such dielectric films remains constant throughout the length of the capacitor. Some conformal transformations of basic cylindrical capacitor cross-sections are given. When these are applied to a symmetric cylindrical capacitor with a thin dielectric film on its electrodes, the results suggest that the mean capacitance per unit length may remain constant to the first order despite the presence of the dielectric film. The same methods also suggest that the individual cross-capacitances per unit length may remain constant to the first order provided that the dielectric film is disposed symmetrically with respect to the capacitor symmetry plane. Further support for these conjectures is given by the results of a detailed calculation of the cross-capacitances per unit length of a parallel-plate cylindrical capacitor with a thin uniform dielectric film on one electrode. A lemma concerning the existence of an equivalent dielectricless capacitor is given and this is followed by the proof of general results of the type suggested by the previous working.

621.319.52 : 537.54

765 THE GENERATION OF DIRECT CURRENT AT HIGH POTENTIALS. W.E.Bennett.

Research, Vol. 12, No. 12, 455-9 (Dec., 1959).

The need for a medium energy machine of high power for use in nuclear research is emphasized and a small ionized gas flow high voltage generator to give a direct current at high potential is described. Various possible applications for such an apparatus are suggested.

LAMPS . ILLUMINATION

621.326.7 : 537.3

766 ENERGY LOSS FROM THE FILAMENT OF AN INCANDESCENT LAMP. J.W.Dewdney.

Amer. J. Phys., Vol. 28, No. 2, 89-91 (Feb., 1960).

The current–voltage characteristic of a light bulb can be analysed graphically to reveal much about heat loss from a hot filament. The low-temperature region is particularly interesting.

ELECTROCHEMISTRY

621.355

767 ELECTRIC BATTERIES FROM RECENT PATENTS. M.Tarrin.

Rev. gen. Elect., Vol. 68, No. 8, 475-85 (Aug., 1959). In French.

This review of recent French patents follows earlier reviews (Abstr. 1065 and 2615 of 1956; 251 and 5245 of 1959) and is concerned with silver–zinc batteries and improvements to extend their life and reliability. It covers plate and separator construction details, their assembly in the case and other novel batteries not covered earlier. Patents for battery charging systems are also discussed. 41 patent references are given. W.A.Walker

621.357.1

768 ELECTRICITY IN THE MANUFACTURE OF HYDROGEN PEROXIDE. B.E.A.Vigers and R.O.Fletcher.

Proc. Instn Elect. Engrs, Paper 3196U, Feb., 1960, 11 pp. To be republished in Vol. 107A (1960).

Gives a brief history of the development and uses of hydrogen peroxide. The electrochemical process is given in some detail, and types of electrolytic cell are mentioned with reference to the electrical characteristics affecting the design. A modern factory with an 11 MW electrolytic load and the main features of the electrical system peculiar to this type of plant are described. Reference is made to the other services concerned and the use of back-pressure turbines and generating plant. A note on the future of the electrochemical process is given.

621.359.4 : 621.311.2

769 . AN ELECTROSTATIC DUST MONITOR. D.H.Grindell.

Proc. Instn Elect. Engrs, Paper 3184S, publ. Jan., 1960, 10 pp. To be republished in Vol.107A, 1960.

A smoke or dust particle carried by an air stream and subjected to high-voltage corona acquires a charge approximately proportional to its external surface area. If such ionized particles are precipitated at a collector electrode, the resultant flow of charge constitutes a current proportional to the rate of deposition of total dust surface, and a significant measure of the toxicity of a chimney discharge is obtained. The theory of a dust monitor incorporating this principle is outlined and some experiments in smoke measurement are described. The operation of prototype equipment in a pulverized-fuel-fired boiler installation is examined.

ELECTRIC HEATING

621.365.2

770 BULK PRODUCTION OF STEEL IN ELECTRIC ARC FURNACES. J.B.Ingall and F.S.Leigh.

Beama J., Vol. 66, No. 4, 129-33 (Nov., 1959).

Electric melting shops for tonnage steel production have increasing potentialities in the U.K. as the cost of electricity tends to become reduced relative to other forms of fuel. The arrangement of an arc furnace is described with particular reference to the refractories, the electrodes, transformers, circuit breakers and the methods of regulation. It is shown that a low-reactance transformer/busbar arrangement with an additional switchable reactor may be economically attractive overall. M.Rathbone

621.365.2

771 COMBINED METHODS FOR THE DETERMINATION OF THE CHARACTERISTICS OF THE ELECTRIC CIRCUIT OF ARC FURNACES. M.Drahný.

Elektrotech. Obzor, Vol.48, No.8, 429-32 (1959). In Czech.

Owing to the difficulties in measuring the characteristic, methods are described for its determination in which calculations of the circuit are combined with easily performed measurements. Recommends the measurement, for this purpose, of the power as a function of the current. N.Klein

621.365.39

772 OFF-PEAK HEATING FOR GLASSHOUSES.

Elect. Times, Vol.136, 417-19 (Oct. 22, 1959).

Examples are given of installations carried out by the Midlands Electricity Board, comprising m.i.c.c. kumana heating cable solidly embedded in a concrete path along the glasshouse floor. Loading was 8 kW for a min. interior temp. of 55° F and a min. outdoor temp. of 20° F, using off-peak energy between 7 p.m. and 7 a.m. and a midday boost from 1 to 3 p.m. Records include thermograms and the general performance is considered satisfactory.

E.H.W.Banner

621.365.39

773 GLASSHOUSE HEATING ANALYSED. R.I.Harris.
Elect. Times, Vol. 136, 420-3 (Oct. 22, 1959).

The storage scheme using heating cables embedded in the concrete floor or path is critically examined, making various assumptions as to heat flow, etc., including that the heat flow from the block is just sufficient to maintain the required house temperature. Accepted "U" values for the materials are used in formulae for power loading and outside and required indoor temperatures. From the calculations and known limitations it is concluded that the method is not sound. E.H.W.Banner

621.365.4

774 THE HIGH-TEMPERATURE VACUUM OVEN. I.Sh.Libin and G.N.Rokhlin.
Pribory i Tekh. Eksper., 1959, No. 3, 150-1 (May-June). In Russian.

A simple compact laboratory oven is described giving temperatures of up to 2000°C. Z.Krasucki

621.365.5

775 EFFECT OF THE TOROIDAL SHAPE OF THE CHANNEL OF RECTANGULAR SECTION ON THE MAGNITUDE OF ELECTRIC POWER GENERATED IN A FERROMAGNETIC MEDIUM IN THE CASE OF A SURFACE EFFECT. D.D.Dobryakov.
Latv.PSR Zinat.Akad.Vestis, No.2 (139), 69-72 (1959). In Russian.

Neiman's formula [Neiman, Surface effect in ferromagnetic bodies, GEI, (1949)], which is usually applied for calculating the active power generated in the ferromagnetic medium due to induction currents and hysteresis taking place in the case of surface effect in strong magnetic fields, does not take into account the effect of the shape of the body on electromagnetic processes. Results are presented of experimental investigations for the case when the fading of the electromagnetic field takes place in a hollow steel toroid with a rectangular-section channel. The significance of the results obtained for the design of low-temperature heating elements with heating coil inside the ferromagnetic medium (Abstr. 6484 of 1959) is discussed. F.Lachman

621.365.9

776 PROCESSING MATERIALS WITH ELECTRON BOMBARDMENT. A.Lawley.
Electronics, Vol. 32, No. 33, 39-41 (Sept. 4, 1959).

The present state of the technique of using electron bombardment to melt refractory materials is reviewed. The rod specimen, mounted in a vacuum better than 10^{-4} mm.Hg., is surrounded by an annular cathode, electron current being drawn from this cathode to the specimen. Due to positive ion bombardment of the cathode it is essential to control power input automatically. A short survey of the uses of this technique includes zone levelling and refining, electron beam melting and electron beam welding. The purity, high-temperature stability and strength of both metals and insulating materials can be improved. B.Dunford

ELECTRIC WAVES AND OSCILLATIONS

621.371

777 EFFECT OF RELATIVELY STRONG FIELDS ON THE PROPAGATION OF E.M. WAVES THROUGH A HYPERSONICALLY PRODUCED PLASMA. W.B.Sisco and J.M.Fiskin.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 240-4 (July, 1959).

The simple classical theory employed in the analysis of electromagnetic waves propagating through an ionized gas is not sufficiently general to take into account the variation of the complex conductivity of the plasma with the magnitude of the impressed e.m. field. Problems of this nature arise when it becomes necessary to transmit radar signals of high energy density through the ionized shock wave produced by a hypersonic vehicle. The exact theory of conductivity developed by Margenau (Abstr. 2139 of 1946) for impressed, relatively high field strengths is too difficult to handle from an analysis and computational standpoint. By making two simplifying assumptions in the general velocity distribution function and graphically interpolating between them, two relations, one nearly exact and one employing the simple theory, are obtained for the conductivity. The accuracy of these relations is then examined analytically for a typical case, and graphical comparisons between the methods are made. Effects of neglecting Coulomb interactions and higher order components in the velocity distribution function are considered briefly. For an example, the complex conductivity of a typical ionized shock wave as a function of field strength and frequency is calculated and plotted.

LINES . NETWORKS . FILTERS

621.372

778 REFLECTION COEFFICIENTS. R.A.Waldron and J.K.Skwirzynski.
Electronic Radio Engr, Vol. 36, No. 12, 464-5 (Dec., 1959).

The reflection and transmission coefficients are considered for reflecting surfaces which have the same medium on either side. It is shown that the reflection coefficient can be written $\cos\theta \cdot e^{j\theta}$ and the transmission coefficient $\sin\theta \cdot e^{j(\theta - \pi/2)}$, θ taking values between $-\pi/2$ and $+\pi/2$.

621.372 : 621.315.61

779 MULTILAYER ABSORBERS FOR ELECTROMAGNETIC WAVES. H.J.Schmitt.
Z. angew. Phys., Vol. 11, No. 9, 335-9 (Sept., 1959). In German.

Discusses the absorption properties of multilayer structures composed of layers of loss-free dielectric interspersed with thin resistance foils. The properties of the individual layers can be chosen to give the complete structure a number of prescribed resonant frequencies at which electromagnetic energy is completely absorbed. The use of a large number of layers enables a large bandwidth to be covered. The transition from a multilayer structure to a gradient type of absorber is mentioned. V.G.Welsby

621.372.412

780 PIEZOELECTRIC RESONATORS FROM ARTIFICIAL CRYSTALS, OF DIPOTASSIUM TARTRATE. J.Zelenka.
Slaboproudy Obzor, Vol. 20, No. 9, 538-41 (1959). In Czech.

Electrical characteristics of resonators made of dipotassium tartrate (DKT) crystals were investigated. It is shown that XZt ψ cuts have a minimum temperature–frequency coefficient at ψ ranging from 35° to 45°. The standard cuts are therefore taken at $\psi = 37°30'$ and $\psi = 45°$. The temperature–frequency curves for these cuts are represented by parabolas. Cuts of the type XYl φ have zero temperature–frequency coefficients at $\varphi = 22°30'$ and $\varphi = 155°$. The equivalent series resistance of a DKT crystal is frequency dependent, which results in the decrease of its Q-factor with increasing temperature. The difference between series and parallel resonance frequencies in DKT crystals is about 3%, which is appreciably higher than that of quartz crystals. From the investigation it is concluded that DKT crystals of the XZt ψ cut ($\varphi = 37°30'$ or 45°) can be employed in wideband filters at frequencies from 50 to 250 kc/s. R.S.Sidorowicz

621.372.413

781 THE DESIGN OF HOLLOW RESONATORS BY THE METHOD OF SUPERPOSITION OF ELECTROMAGNETIC WAVES. Yu.N.Kazantsev.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1480-4 (Sept., 1959). In Russian.

Considers a resonator consisting of a section of waveguide of arbitrary cross-section and end planes perpendicular to the waveguide axis. The method of superposition of multiply-reflected waves is used to derive practical formulae for the quality factor, transmission coefficient and adsorbed power in such a resonator with non-ideal walls and a number of coupling elements. The magnitudes appearing in the formulae have a simple physical significance and can be found experimentally or by calculation from the travelling-wave state. D.E.Brown

621.372.5

782 DISSIPATIVE NETWORKS WITH THIRD-ORDER MAXIMALLY-FLAT-AMPLITUDE CHARACTERISTICS. J.B.Rudd.

A.W.A. tech. Rev., Vol. 11, No. 1, 1-36 (1959).

An analysis is made of dissipative low-pass networks with third-order maximally-flat-amplitude characteristics; a simple change of frequency variable adapts the results to band-pass cases. The limitations of the simple band-pass network, in narrow-band working, leads to the development of a network with quarter-wave couplings between resonators; the relationship of this network to the familiar triple-tuned circuit is found to be a simple one. Questions of departure from the maximally-flat-amplitude characteristics are discussed. Networks with minimum insertion loss are derived. By-products of the main analysis include: the development of networks loaded on one side only; low-pass networks with unequal terminations; networks with equal reactance structures but unequal resistance distribution. A brief discussion of a maximally-flat-amplitude network composed of tandem-connected 3-element Zobel sections, one of each type, is given.

621.372.5

783 CHARACTERISTICS OF VARIABLE NETWORKS. M.Saito.

J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 8, 725-30 (Aug., 1959). In Japanese.

The networks considered consist of a finite number of lumped linear elements, one of which is variable, and the network functions must be of the form

$$F(p,\lambda)=\frac{g_0(p)+\lambda g_1(p)}{f_0(p)+\lambda f_1(p)} \text{ or } \frac{G_0(p)+\lambda G_1(p)}{f_0(p)+\lambda f_1(p)},$$

where f_0, f_1, g_0 and g_1 are polynomials of the complex frequency p with real coefficients, G_0 and G_1 are symmetrical matrices whose elements are polynomials of p with real coefficients, and λ is the parameter representing the immittance of the variable element. The types of network investigated are those consisting of (a) R, L and C elements and ideal transformers, (b) R and C elements and ideal transformers, (c) R, L and C elements and unilateral amplifiers. The necessary and sufficient conditions are determined for $F(p,\lambda)$ to be realizable as (a) a driving-point immittance or an immittance matrix, (b) a driving-point admittance or an admittance matrix, (c) a transfer function. These conditions are all clearly given in the author's English abstract. The properties of the network functions derived for variable networks can also be applied to problems concerning active networks and concerning the tolerances of network elements. A.Wilkinson

621.372.5

784 CALCULATION OF DYNAMIC FREQUENCY CHARACTERISTICS OF LINEAR PASSIVE SYSTEMS. L.G.Sodin.

Radiotekhnika, Vol. 14, No. 7, 8-16 (July, 1959). In Russian.

The response of a signal whose frequency increases linearly with time is calculated for a simple resonant circuit and for a band-pass circuit with two tuned elements. Formulae and graphs are presented which show how the response curve is distorted as the "scanning" speed is varied. The analysis is also extended to the case when a large number of similar filters are connected in cascade. S.C.Dunn

621.372.533

785 DESIGN OF ENVELOPE DELAY EQUALIZERS ON THE ANALOGY PRINCIPLE. K.Bernath, B.Binz and E.Salvetti.

Tech. Mitt. P.T.T., Vol. 37, No. 10, 445-52 (1959). In German.

After showing that the complex transmission factor of any all-pass filter can be considered as equivalent to that of a network of "n" elementary filters, a method of solving the design problem by means of pole and zero filter representation is suggested, illustrated in a table which contains the lattice configuration, pole and zero diagram, ω, L and C values and the delay periods τ (τ_0, τ_∞ and τ_{max} where τ_0 and τ_∞ relate to $\omega \to 0$ and $\omega \to \infty$). The numerical solution depends then on the application and interpretation of a d.c. potential analogue, consisting of a matrix of series and parallel resistances. The recommended analogue, employing 20 elements in the y-direction (k-axis) and 52 elements in the x-direction (ω - axis) consists of the resistive matrix with sockets at all intersections and the input and output signal appliances and measuring facilities. A complete equalizer for a video amplifier of given characteristics is then worked out, illustrated by performance curves and oscillographs of its square-wave response. An extensive bibliography is quoted. A.Landman

621.372.54 : 621-526

786 NOTES ON BRIDGED-T COMPLEX CONJUGATE COMPENSATION AND 4-TERMINAL NETWORK LOADING. P.Chandaket and A.B.Rosenstein.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 148-63 (1959) = Applic. and Industr. No. 43 (July, 1959).

Describes the use of elementary bridged-T networks for the compensation of d.c. servo systems. Curves are developed which allow easy synthesis of an unloaded network with its zero falling at any prescribed point in the left half plane. The effect of loading the network is investigated. The application of the loaded network to the compensation of a position servo is described. W.A.Cameron

621.372.542.21 : 621.374.34

787 A STUDY OF THE CHANGE IN SPECTRUM OF A RECTANGULAR HIGH FREQUENCY PULSE IN PASSING THROUGH A TUNED PI-SECTION FILTER AND AN AMPLITUDE LIMITER. N.M.Boldyrev.

Radiotekhnika, Vol. 14, No. 8, 14-21 (Aug., 1959). In Russian.

There is a change in the envelope of the maxima in the distribution of spectral density which is most pronounced at a particular frequency close to the centre frequency of the filter. A physical explanation for the effect is given in terms of mutual interference between signals at characteristic frequencies corresponding to particular features of the filter. S.C.Dunn

621.372.542.29

788 AN ANALYSIS OF A TYPE OF COMB FILTER. A.G.J.MacFarlane.

Proc. Instn Elect. Engrs, Paper 3121E, publ. Jan., 1960 (Vol. 107A, 39-52).

Several basic arrangements of delay unit, combining unit and feedback unit are shown to have amplitude/frequency response characteristics of the type which has given rise to the name comb filter. Such filters are useful for the selection or rejection of a train of uniformly spaced regular pulses. The response of the most suitable configurations to such a train of pulses and to a Gaussian noise input is investigated with particular reference to the improvement in signal/noise ratio possible with this type of filter. The practical realization of such filters is discussed and the most suitable forms of practical comb filter are indicated together with a brief discussion of their incorporation into a radar system.

621.372.543.3

789 A SUPPRESSION FILTER WITH VARIABLE BANDWIDTH. J.Davidse and B.T.J.Holman.

Tijdschr. Ned. Radiogenoot., Vol. 24, No. 4, 199-209 (1959).

A suppression (notch)-type filter with variable bandwidth was required for transmission measurements on colour television signals. The frequency to be suppressed was 4.1 Mc/s. A bridged-T circuit is used. The loading capacitance is neutralized by means of a feedback circuit which also enables negative loads and consequently very small bandwidths to be obtained. The transient response and overshoot of the filter are calculated. G.N.J.Beck

621.372.57

790 SYNTHESIS OF ACTIVE RC NETWORKS. B.K.Kinariwala.

Bell Syst. tech. J., Vol. 38, No. 5, 1269-316 (Sept., 1959).

A basic theorem is derived for RC networks containing active elements. It is shown that no more than one active element, embedded in a passive RC network, is needed to realize any driving-point function. Sufficiency of only one active element is shown by developing a synthesis method. A synthesis technique for n-port passive RC networks is developed in order to establish the sufficiency proof of the basic theroem. A more practical method of realizing driving-point functions, using active RC networks, termed the "cascade" method, is also presented. This method is applied to the design of a tenth-order Chebyshev parameter filter.

621.372.6

791 VOLTAGE AND CURRENT TRANSFORMATION MATRICES. I.Cederbaum.

Proc. Instn Elect. Engrs, Monogr. 355, publ. Feb., 1960, 5 pp. To be republished in Part C.

Transformation matrices relating two adequate systems of simple network coordinates such as node-pair voltages or link currents belong to the class of unimodular or E-matrices. A distinction is made between the matrices corresponding to such voltage and current transformations, and different sets of necessary conditions are derived for each type. Since the loop- and cut-set-to-branch incidence matrices are closely related to transformation matrices, the discussion proposes new sets of necessary conditions for incidence matrices corresponding to systems of node-pair voltages or link currents. Examples are given of matrices which whilst representing a voltage transformation cannot represent a current transformation and vice versa. Another example shows an E-matrix which can represent neither a voltage nor a current transformation.

621.372.6

792 IMPEDANCE AND LAGRANGE FUNCTION OF A LINEAR DISSIPATIVE NETWORK. J.Meixner.
Z. Phys., Vol. 156, No. 3, 200-10 (1959). In German.

A simple proof is given for the theorem that the difference between electrical and magnetic energies is the same for equivalent 2n-terminal networks to which the same electromotive forces are applied. For this difference, called the Lagrange function, an explicit expression in terms of the admittance matrix is given. An analogous theorem is proved in the thermodynamic theory of relaxation phenomena and an extension is given to the case of general linear dissipative systems.

WAVEGUIDES

621.372.821

793 DESIGNING MICROWAVE PRINTED CIRCUITS. A H.Lytel.
Electronic Industr.,Vol. 18, No. 11, 88-93 (Nov., 1959).

A brief general account of the subject. Various types of strip line, the dielectric materials used and typical components are described. E.A.Ash

621.372.821 : 538.56

794 SURFACE WAVES IN FERRITE WAVEGUIDES. A.L.Mikaélyan and A.K.Stolyarov.
Radiotekhnika i Elektronika, Vol. 4, No. 7, 1079-93 (July, 1959). In Russian.

Starts by summarizing the familiar properties of waves in 3 types of parallel plane waveguide: (1) with no conducting side walls and containing an ordinary dielectric layer with faces perpendicular to the planes; (2) with one conducting side wall next a dielectric layer face; (3) normal rectangular waveguide — 2 conducting side walls — with a dielectric layer face next one side wall. These 3 cases are next discussed theoretically with ferrite replacing the dielectric layer. Experimental curves are illustrated, showing the direct and reverse wave attenuations as functions of external magnetic field for different thickness of ferrite layer in rectangular waveguide. The results indicate that a waveguide can be produced with cutoff in a single direction of propagation. D.E.Brown

621.372.821

795 OVERMODED WAVEGUIDES OPTICAL APPROACH TO MODE CONVERSION. L.Solymar.
Electronic Radio Engr, Vol. 36, No. 11, 426-8 (Nov., 1959).

The amplitudes of the spurious modes generated at the joint of two overmoded waveguides are calculated. One of the waveguides is circular and is excited by an H_{0n} mode, the cross-section of the other waveguide is slightly different. It is shown that no E modes are excited by the joint. The amplitudes of H modes are expressed in a closed form.

621.372.822

796 MODE CONVERSION IN PYRAMIDAL-TAPERED WAVEGUIDES. L.Solymar.
Electronic Radio Engr, Vol. 36, No. 12, 461-3 (Dec., 1959).

It is shown that if two rectangular waveguides of different cross-section are connected by means of a taper higher-order modes will be generated. The electric intensities in the taper and in the large waveguide are determined, the amplitudes of the spurious modes are computed and an extension of the results discussed. A simple design formula is derived for the determination of the necessary length of the taper for a stated mode conversion figure.

621.372.832

797 GYROMAGNETIC MODES IN WAVEGUIDE PARTIALLY LOADED WITH FERRITE. S.Seidel and R.C.Fletcher.
Bell Syst. tech. J., Vol. 38, No. 6, 1427-56 (Nov., 1959).

Analysis is made of all the propagating modes of a vanishingly small rectangular waveguide partially filled with transversely magnetized ferrite. Each of these modes is shown to propagate in only one direction and to tend to be lossy. Use of these properties can be made in the design of a novel nonresonance isolator. All but one of the propagating modes vary in amplitude along the d.c. magnetic field, yet they can apparently be excited experimentally at a boundary by an incident mode, with none of the modes having any variation along the d.c. field. Theoretical considerations indicate that finite conductivity in the waveguide walls may be responsible for this coupling. The unidirectional properties of these modes suggest the possibility of building purely reactive isolators, but these can be shown nonexistent from general energy considerations. Experiments are described that show that nature resolves this "paradox" by absorbing power, even in low-loss ferrite, rather than reflecting it. Some possible explanations of this behaviour are set forth.

621.372.822 : 621.372.413

798 THE APPLICATION OF LAPLACE TRANSFORMS TO THE THEORY OF RECTANGULAR HOLLOW RESONATORS AND WAVEGUIDES. M.I.Kontorovich.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1475-79 (Sept., 1959). In Russian.

Uses Laplace transforms to solve the problem of the excitation of a hollow perfectly conducting resonator and waveguide. The solution is in the form of a multiple integral which is easily reducible to the familiar series solution. The method is claimed to have a wide application and to be advantageous in a number of cases, e.g. a waveguide with dimensions that are large compared with the wavelength. D.E.Brown

621.372.822

799 WAVEGUIDE BENDING DESIGN ANALYSIS. THEORY OF BENDING AND FORMULAE FOR DETERMINATION OF WALL THICKNESSES. F.J.Fuchs, Jr.
Bell Syst. tech. J., Vol. 38, No. 6, 1457-84 (Nov., 1959).

The art of rectangular tube bending is analysed, with particular attention being given to tube wall thickness variations. Effects of these variations on tool design are discussed, and methods and formulae for determination of wall distortions are presented.

621.372.822 : 538.56

800 THE THEORY OF WAVEGUIDES OF VARIABLE CROSS-SECTION.
V.L.Pokrovskii, F.R.Ulinich and S.K.Savvinykh.
Radiotekhnika i Elektronika, Vol. 4, No. 2, 161-71 (Feb., 1959). In Russian. English summary: PB 141106T-13 obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The e.m. wave propagation in a plane waveguide with perfectly conducting walls, whose angle of inclination to the waveguide axis is assumed to be small although the total (monotonic) change in cross-section is finite, is evaluated. The differential equation is solved approximately by a combination of the Wentzel–Kramers–Brillouin method and the perturbation method. The transmission, reflection and scattering coefficients are worked out when only one wave of index 1 is propagated, and two particular cases of waveguides are considered. It is shown that only the phase changes are substantially dependent on the form of the waveguide, the amplitudes being mainly determined by irregularities at joints of the regular waveguide sections. See also following abstract. D.E.Brown

621.372.822 : 538.56

801 A RECTANGULAR WAVEGUIDE OF VARIABLE CROSS-SECTION. M.S.Rÿvkin.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1465-74 (Sept., 1959). In Russian.

Considers the e.m. wave propagation down a rectangular waveguide with perfectly conducting walls and slowly (monotonically) increasing cross-section. See preceding abstract for the general mathematical method. General expressions are worked out for the

reflection and scattering coefficients, and applied to the particular case of two square waveguides of different sides with an intermediate trumpet-shaped adaptor. D.E.Brown

621.372.823

802 THE FARADAY EFFECT IN WAVEGUIDES. R.Kronig.
Ned. Tijdschr. Natuurkde, Vol. 25, No. 8, 217-26 (Aug., 1959). In Dutch.

Review article, confined to guides of circular cross-section. Covers the basic electromagnetic theory, calculation of the gyromagnetic permeability tensor, and experimental results for standing and running waves with ferroxcube filling. B.Meltzer

621.372.823 : 538.56

803 A NON-ISOTROPIC ELLIPTICAL WAVEGUIDE. E.S.Kovalenko.
Dokl. Akad. Nauk SSSR, Vol. 128, No. 2, 276-9 (Sept. 11, 1959). In Russian.

A waveguide filled with a magnetized ferrite is considered. The solution is obtained for the propagation component of the electric field in terms of Mathieu functions and a transcedental equation is derived for the critical propagation constant. The polarization properties of the system are discussed. J.K.Skwirzynski

621.372.826

804 POWER FLOW AND NEGATIVE WAVE IMPEDANCE IN THE DIELECTRIC-ROD WAVEGUIDE. E.F.F.Gillespie.
Proc. Instn Elect. Engrs, Monogr. 362E, publ. Feb., 1960, 4 pp. To be republished in Part C.

In most waveguides of practical interest the wave impedance in the direction of propagation of the wave is positive and its magnitude does not vary with position. It is shown that, in general, a guiding structure supporting a hybrid mode, i.e. a mode having axial components of both the electric and magnetic fields, can present a negative wave impedance. The case of the EH_{11} mode on a dielectric rod is then considered, and it is shown that for this mode the wave impedance is negative over part of the transverse plane and hence leads to regions of negative power flow if the usual interpretation of the Poynting vector is employed. The total power flow, however, is still positive, since the negative power density and the negative wave impedance occur only in a restricted part of the cross-section. The orthongonality of the fields is also discussed, and it is shown that for hybrid modes the transverse electric and magnetic fields are not at right angles to each other.

621.372.826

805 A VARIATIONAL EXPRESSION FOR THE TERMINAL ADMITTANCE OF A SEMI-INFINITE DIELECTRIC ROD. C.M.Angulo and W.S.C.Chang.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 207-12 (July, 1959).

The reflection that the abrupt termination of a semi-infinite circular dielectric rod produces on the $TM_{0,1}$ surface wave is determined here by calculating the terminal admittance of the surface wave at the end of the rod. The semi-infinite dielectric rod is regarded as an open waveguide partially filled with dielectric. The half space at the end of the rod is analysed as a homogeneous open waveguide. The complete sets of proper and improper eigenfunctions are found for both waveguides and used to represent the transversal fields. Finally, a variational expression is set up for the admittance and an approximate value is obtained using as trial field the pure $TM_{0,1}$ surface wave.

621.372.826

806 THE GOUBAU LINE. R.Hübner.
Tech. Mitt. P.T.T., Vol. 37, No. 10, 453-8 (1959). In German.

(See also Abstr. 638 of 1951). A review of developments in the use of surface wave transmission lines (dielectric-covered single conductors). The method of matching to a coaxial cable by means of a horn is described and typical attenuation and impedance characteristics are given. W.G.Stripp

621.372.826

807 SURFACE-WAVE TRANSMISSION LINE COMPOSED OF DIELECTRIC MEMBRANE. M.Sugi and T.Nakahara.
J.Inst. Elect. Commun. Engrs Japan, Vol.42, No.8, 731-7 (Aug., 1959). In Japanese.

Two possible constructions of such transmission lines are described, termed O-guide and X-guide respectively. The O-guide consists of a dielectric tube of circular section, while the membrane of the X-guide is supported by an internal X-section frame. The propagation of the TE fundamental mode through the O-guide is analysed and the theoretical characteristics of such a guide consisting of a polyethylene tube are discussed. The results indicate that such lines are especially suitable for u.h.f. and may have lower attenuation constants than coaxial lines, rectangular waveguides or the Goubau G-line. A.Wilkinson

621.372.829

808 TWISTED WAVEGUIDES. B.Z.Katsenelenbaum.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1444-7 (Sept., 1959). In Russian.

See Abstr. 3599 (1959). Uses the method of cross-sections to calculate the field in a twisted waveguide of rectangular or elliptic cross-section (the latter of small eccentricity) and considers in particular the conditions that exist when the phase velocities of the waves coupled by the twist are almost equal. D.E.Brown

621.372.831

809 THE LEAST POSSIBLE LENGTH OF A SMOOTH TAPER. A.L.Fel'dshtein and L.R.Yavich.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1455-59 (Sept., 1959). In Russian.

By passing to the limit from a stepped Chebyshev to a smooth taper, an expression is obtained for the minimum taper length in terms of the maximum wavelength of the pass band, the wave impedance ratio of the matched lines and the permissible mismatch Γ_{max}. Curves are reproduced to facilitate finding the minimum length with $\Gamma_{max} = 0.02, 0.05, \ldots, 0.2$. Two numerical examples are included. D.E.Brown

621.372.831

810 THE THEORY OF SMOOTH TAPERS WITH "GUARANTEED" MATCHING. M.E.Gertsenshtein.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1460-64 (Sept., 1959). In Russian.

Points out that the true (unknown) value R of the reflection coefficient for a given waveguide or coaxial taper is the vector sum $R = R_1 + R_2$, where R_1 is the reflection coefficient obtained by all the usual (first approximation) methods, and R_2 is the error. Guaranteed matching, as required especially in measurement work, demands a knowledge of the conditions in which not only $R_1 \sim 0$ but also $R_2 \sim 0$. A mathematical discussion of this problem makes clear the influence on matching errors both of multiple reflections and of higher wave types. D.E.Brown

621.372.831

811 MODE CONVERSION AT THE JUNCTION OF HELIX WAVEGUIDE AND COPPER PIPE. J.W.Lechleider.
Bell Syst. tech J., Vol. 38, No. 5, 1317-29 (Sept., 1959).

Scattering coefficients for a junction of helix waveguide and copper pipe are calculated. Fields exterior to the helix in the helix waveguide are neglected, but no other approximations are made.

OSCILLATORS . PULSE GENERATORS

621.373.4 : 621.317.39

812 SENSITIVE TRANSDUCERS USE ONE-TUBE CRYSTAL OSCILLATOR. L.J.Rogers.
Electronics, Vol. 32, No. 40, 48-9 (Oct. 2, 1959).

The tuning circuit of the one-valve oscillator is in two parts, one in the box containing the valve and its associated crystal, while the other part may be remote from the oscillator and associated with the transducer, thus rendering the arrangement suitable for hazardous situations. The transducer itself can operate by a change of capacitance, inductance or resistance. The crystal-controlled, electronically coupled oscillator is connected in a triode–tetrode configuration and supplies a radio frequency voltage to the transducer circuit. The remote circuit is tuned to a selected side of the combined system resonance curve so that there is reasonable linearity in the relation between capacitance change and output signal amplitude (for example). A.C.Whiffin

621.373.4

813 FREQUENCY STABILIZATION OF A WIDEBAND OSCILLATOR USING A DELAY LINE. N.N.Nesvit.
Radiotekhnika, Vol. 14, No. 8, 52-6 (Aug., 1959). In Russian.

A multiplying circuit is fed directly from an oscillator and also through a delay line. The output of the multiplier is integrated, smoothed and applied to the network which controls the frequency of the oscillator. By this means a series of stabilized frequencies may be obtained which are spaced over the frequency range at constant intervals. An example is given of the design of an oscillator which will produce calibrating signals at intervals of 20 kc/s in the range 20-30 Mc/s. S.C.Dunn

621.373.4

814 A QUALITATIVE THEORY OF THE ASYNCHRONOUS STATES IN SELF-OSCILLATORY SYSTEMS WITH 2 DEGREES OF FREEDOM. A.A.Magazanik.
Radiotekhnika i Elektronika, Vol. 4, No. 7, 1103-15 (July, 1959). In Russian.

Such a theory has so far only been developed for systems containing a single idealized non-linear element with a characteristic expressible as a third- or fourth-degree polynomial. The present theory extends to systems requiring for their elucidation an oscillator model containing one or several more complex non-linear elements. The structure of the linear part of the system plays no part in the approximation considered, since it may be described simply by several general parameters whose values can easily be written for a given concrete arrangement. The non-linear elements are given in a concrete form for most practical cases. Experimental oscillograms etc. are given in reference to a single triode oscillator capable of single or double frequency excitation.
D.E.Brown

621.373.4

815 SOME FEATURES OF TRANSIENTS IN ASYNCHRONOUS OSCILLATORS WITH TWO DEGREES OF FREEDOM AND MARKEDLY DIFFERENT NATURAL OSCILLATION DAMPING COEFFICIENTS. A.A.Magazanik.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1359-67 (Aug., 1959). In Russian.

For terminology and notation see preceding abstract. The work applies e.g. to an oscillator with a parasitic circuit whose natural frequency is much higher or lower than that of the main circuit. The phase diagram is considered theoretically, and approximate solutions worked out for three transient states. The possibility is shown of strong fluctuation and substantial lengthening of transient oscillatory pulses of frequency corresponding to the greater of the damping coefficients. The conditions for rapid damping of these pulses are considered, together with the conditions for establishing single frequency operation corresponding to the lesser of the damping coefficients.
D.E.Brown

621.373.431

816 TOPOLOGICAL METHODS APPLIED TO ELECTRONICS. L.Sideriades.
Rev. gen. Elect., Vol.68, No.8, 497-511 (Aug., 1959). In French.

The properties of the singularities of first-and second-order topological systems are summarized using a matrix method. A non-linear electronic element can be represented by a surface and the stability of the system can be determined by consideration of the type and distribution of the associated singularities. The application of the topological theorems discussed is illustrated with reference to a variety of coupled electronic systems employing one or two valves, e.g. the limit cycles of a single-valve oscillator and of a gyroscopic multivibrator can be determined and from a study of the singularities of similar systems, a circuit possessing four stable states is deduced. G.D.Sims

621.373.44

817 CALCULATION OF THE RISE TIMES OF THE PULSE IN A PHANATASTRON CIRCUIT. G.I.Perov.
Radiotekhnika, Vol. 14, No. 8, 63-70 (Aug., 1959). In Russian.

The method is graphical and is based upon the use of a special anode characteristic which has been described previously (see Abstr. 3617 of 1957). The method is directly applicable to the analysis of transient processes occurring in the absence of external excitation. Account may be taken of triggering by a rectangular pulse. Some recommendations are made about an optimum choice of circuit parameters. The valves considered are types 6A7, 6ZH2P, and 6ZH2B. S.C.Dunn

621.373.5

818 TRANSISTOR SINE-WAVE LC OSCILLATORS. P.J.Baxandall.
Proc. Instn Elect. Engrs, Paper 2978 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1959 (Vol. 106B, Suppl. No. 16, 748-58).

It is shown that various well-known simple oscillator circuits, usually analysed separately, are essentially equivalent to one another if certain reasonable assumptions are made, and appreciation of this fact simplifies the design problem. A discussion follows concerning class-C oscillators and the difficulty of combining high efficiency with a satisfactory degree of independence of transistor parameters. The problem of avoiding squegging is also considered. A simple push-pull high-efficiency oscillator is then described, in which substantially constant current flows in each transistor for the whole of its 180° conduction angle. This oscillator is believed to process a unique combination of desirable features. Another unusual high-efficiency oscillator is then presented, which is more elaborate than the previous one but which has advantages in certain respects. Finally, a description of an oscillator based on the "long-tailed-pair" circuit is given. The oscillator is exceptionally easy to design and make, and is suitable for applications where high efficiency is not important. It can supply either a sine wave or a square wave, or both.

621.373.52

819 AN EXPERIMENTAL TRANSISTORIZED ARTIFICIAL LARYNX. H.L.Barney, F.E.Haworth and H.K.Dunn.
Bell Syst. tech. J., Vol. 38, No. 6, 1337-56 (Nov., 1959).
For abstract, see Abstr. 7296 of 1959.

621.373.52 : 621.395.44

820 THE APPLICATION OF TRANSISTORS TO THE GENERATION OF STABLE-FREQUENCY SUPPLIES FOR CARRIER TELEPHONE EQUIPMENT. L.J.Herbst, R.H.Moffett, R.F.Purton and J.L.Slow.
Proc. Instn Elect. Engrs, Paper 3039 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 16, 613-18).

Frequency-division-multiplex telephone terminal equipment requires a series of stable carrier-frequency supplies, together with other frequencies for pilot and signalling purposes. Surveys the application of transistors to the generation of these supplies, with reference to circuits designed to meet typical requirements. Carrier supplies are usually derived from a single master oscillator and the design of such an oscillator with a long-term frequency stability of better than one part in 10^8 is discussed. Circuits for the derivation of groups of carrier frequencies from the master source are also described. These include harmonic generators and a divider of the regenerative-modulator type. Power levels required at the various carrier frequencies vary from a few milliwatts to several watts for different frequencies and applications. Some of the problems of obtaining stable amplification with transistors at high levels and high frequencies are illustrated by examples of amplifier design for frequencies up to 612 kc/s. A particular problem is the supply of pilot signals having an extremely stable amplitude The design of an effective constant-output amplifier for this purpose is described.

621.373.52

821 TEMPERATURE DEPENDENCE OF POWER CHARACTERISTICS OF TRANSISTOR OSCILLATORS. S.M.Gerasimov.
Radiotekhnika, Vol. 14, No. 7, 33-9 (July, 1959). In Russian.

A theoretical and experimental investigation of transistor characteristics at low frequencies as a function of temperature is presented. The investigation covers germanium junction devices in the range from −75° to +75°C, but the deductions also apply to diffused transistors. Differences in characteristics between conditions of constant junction temperature and constant ambient temperature are considered and taken into account. Brief analysis of thermal stabilization of collector current conditions (current flow, current pulse angle, cut-off), of self-oscillation criteria and of constant collector current maintenance are supplied, also information on measuring techniques; actual stabilization circuits are not discussed. A.Landman

621.373.52

822 A TRANSISTOR OSCILLATOR WITH LIMITATION IN THE SATURATION REGION. A.N.Bazhan and L.N.Kaitsov.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1549-56 (Sept., 1959). In Russian.

Investigates theoretically and experimentally the establishment of almost harmonic self-oscillation in a saturation transistor oscillator, and deduces suitable oscillator design formulae. The oscillator frequency is seen to be slightly lower than the natural frequency of the *LC* circuit and to decrease with increasing regeneration. The oscillation amplitude is independent of load impedance (above a certain minimum) and is determined by the collector supply voltage. Experimental curves refer to a type P2B at 2 kc/s. D.E.Brown

621.373.52

823 THE PROBLEM OF THE ESTABLISHMENT OF OSCILLATIONS IN TRANSISTOR OSCILLATORS. L.N.Kaitsov, K.Ya.Senatorov and O.I.Poliavskaya.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1557-62 (Sept., 1959). In Russian.

Carries out linear and non-linear analyses and shows the possibility of obtaining stationary self-oscillation in the active domain of a transistor with transformer feedback and additional capacity in the emitter circuit. The state in question depends on the form of the relationship between the input conductance and emitter voltage. Experimental curves relate to the 30-70 kc/s range. D.E.Brown

621.373.531.1

824 TEMPERATURE COMPENSATION IN TRANSISTOR FLIP-FLOPS. E.I.Model' and A.G.Aleksenko.
Radiotekhnika, Vol. 14, No. 7, 40-8 (July, 1959). In Russian.

The circuit investigated consists of two transistors with a common emitter load, the first base supplied from a bias potentiometer, the second being series-resistance fed from the supply rail and a.c. coupled to the first collector. The conception of the "coefficient of instability" S, defined in $I_C = I + (S \times I_{CO})$, is introduced and shown to depend for the first transistor on α and the base potentiometer and emitter-resistor values. Formulae are then derived for the pulse duration and optimal S, leading to calculation of optimal values for the best thermal compensation; transistors used are types P13, P14 and P15, and the temperature range extends from 20° to 70°C. An experimental verification indicates good agreement with theory. Effects of transistor parameter and component tolerances and of changes in the supply voltage are also investigated. A.Landman

621.373.544

825 A SCHMITT TRIGGER USING JUNCTION TRIODES. G.P.Petin.
Radiotekhnika, Vol. 14, No. 9, 25-8 (Sept., 1959). In Russian.

Gives the circuit and analysis of a transistor Schmitt trigger, where the possibility of using a thermistor to stabilize the threshold potential against temperature variation is briefly considered. Details are given of methods in which the basic Schmitt trigger circuit can be applied to the generation of rectangular and saw-tooth pulses. V.V.Zakharov

621.373.544

826 ANALYSIS AND DESIGN OF A TRANSISTOR LINEAR-DELAY CIRCUIT. R.P.Nanavati.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 577-80 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

An analysis is presented of the emitter-coupled linear-time-delay circuit as well as a systematic design procedure which starts with a practical set of specifications. Some important fundamental limitations on the operation and design of the circuit are also presented. Experimental data are included to give an idea of the range of validity of the theory. A range of the ratio of maximum-to-minimum pulse width as high as several hundred has been obtained as compared with 10 or 20 obtainable from a similar vacuum-tube circuit. A ratio in excess of 30 was obtained with a deviation from linearity of less than 3%. Stages of this circuit have been successfully operated in cascade.

PULSE CIRCUITS . DIGITAL CIRCUITS SWITCHING CIRCUITS

621.374.32 : 681.142

827 ON THE ANALYSIS OF POTENTIAL–IMPULSE SYSTEMS BY MEANS OF SPECIAL TRANSFER OPERATORS. A.D.Talantsev.
Dokl. Akad. Nauk SSSR, Vol. 127, No. 2, 320-3 (July 11, 1959). In Russian.

Attempts to devise an algebraic method for the analysis of digital systems having simultaneously potential and impulse variables. The method is based on two special operators which can be applied to Boolean functions thus extending the use of the latter to the systems as above. Considers only systems in which all input conditions are expressed by potential variables and all output conditions by impulse variables. Gives one example. W.Bezdel

621.374.32

828 SEMICONDUCTOR COMPARATOR CIRCUITS. G.L.Hoehn, Jr.
I.R.E. WESCON Convention Record, Vol. 3, Pt 2, 102-10 (1959).

The accuracy of comparators is subject to basic theoretical limitations (quantum and entropy considerations) as well as practical limitations (noise and long-term drift). These are reviewed. The comparison operation is nonlinear and sharpness criteria show the advantage of semiconductor devices over thermionic diodes. A specific regenerative (preferable) comparator circuit is analysed. A.Sczaniecki

621.374.32 : 681.142

829 AN ELECTRO-OPTICAL SHIFT REGISTER. T.E.Bray.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 113-17 (June, 1959).

An electro-optical shift register composed only of electroluminescent and photoconductive cells was designed and successfully operated. While its measured operating speed probably does not make this shift register currently competitive in high-speed applications, it is amenable to construction in an extremely small volume, and has certain other unique characteristics.

621.374.32

830 A SIMPLIFIED LOGARITHMIC INTEGRATOR CIRCUIT. H.E.De Bolt.
I.R.E. Trans Nuclear Sci., Vol. NS-6, No. 2, 74-7 (June, 1959).

Describes a simplified logarithmic integrator circuit as well as a synthesis technique for designing this circuit for a specific application. Comparisons are drawn between the circuit proposed herein and the Cooke–Yarborough log integrator circuit and Lichtenstein log integrator circuit.

621.374.32 : 681.142

831 MAGNETIC CORE LOGIC IN A HIGH-SPEED CARD-TO-TAPE CONVERTER. E.Bloch and R.C.Paulsen.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 169-81 (June, 1959).

Describes a static magnetic shift circuit and the logical connectives derived from it. The application of these circuits to the design of the card-to-tape convertor is discussed.

621.374.32

832 INTEGRATED DEVICES USING DIRECT-COUPLED UNIPOLAR TRANSISTOR LOGIC. J.T.Wallmark and S.M.Marcus.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 98-107 (June, 1959).

A new logic system using directly coupled unipolar transistors is analysed. It is shown that unipolar transistors have important advantages over bipolar transistors in speed, tolerance of stray signals and noise, and device miniaturization. Devices of extreme miniaturization built by an integrated device design and using this logic system are then described. It is then shown how the passive components of the system, in this case resistors, are integrated into the semiconductor devices.

621.374.32 : 621.382.233 : 537.311 : 539.2

833 TWO-TERMINAL ASYMMETRICAL AND SYMMETRICAL SILICON NEGATIVE RESISTANCE SWITCHES. R.W.Aldrich and N.Holonyak, Jr.

J.appl. Phys., Vol.30, No.11, 1819-24 (Nov., 1959).

By making use of an emitter region shorted by a metallic contact to an adjacent base region, a new form of p–n–p–n switch is obtained. Several new structures are described, including a symmetrical (or a.c.) switch. Typical experimental results on switches which breakdown in the range from 25 to 40 V are presented.

621.374.32

834 BOOLEAN MATRIX EQUATIONS IN DIGITAL CIRCUIT DESIGN. R.S.Ledley.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 131-9 (June, 1959).

A systematic digital computational method is given that involves the use of Boolean matrix equations for solving certain types of functional circuit design problems. Specifically, all sets of Boolean functions $f_1(A_1, \cdots, A_I)$, $\cdots$, $f_J(A_1, \cdots, A_I)$ are found such that if circuits with these output functions are connected to a circuit that generates the known Boolean function $F(f_1, \cdots, f_J, X_1, \cdots, X_K)$, then the output will produce a given desired function $E(A_1, \cdots, A_I, X_1, \cdots, X_K)$. Illustrative examples of the method are presented.

621.374.32 : 621.318.57

835 SWITCHING CIRCUITS FOR MISSILE COUNT-DOWNS. D.W.Boensel.

Electronics, Vol. 32, No. 31, 76-8 (July 31, 1959).

If is often desired to halt some operation such as a missile count-down, pull a faulty component from a production line or perform some similar function. In such an operation a number of variables are continuously compared against a pre-determined reference. An a.c. level-sensitive switch has been developed as a reliable comparator. It utilizes transistors and is stable to ± 1.5% over 100°C temperature range with a switching gain of 40 dB. It derives its stability from non-linear negative feedback which results in characteristics insensitive to either active component or temperature changes. The basic comparator consists of a somewhat unconventional mono-stable multivibrator followed by a rectifying transistor and filter. The development and final circuit of the switch is described with the associated waveforms. The method of calculating the minimum triggering level etc. is given.

B.B.Austin

621.374.32 : 621.318.57

836 USING INDUCTIVE CONTROL IN COMPUTER CIRCUITS. W.M.Carey.

Electronics, Vol. 32, No. 38, 31-3 (Sept. 11, 1959).

In transistor circuits for switching and the like, if a temporary storage medium is required, inductance can often conveniently be used in place of the capacitance which would be used in similar thermionic-tube circuits. Details are given of circuits designed on this principle with the following functions: differentiation; pulse inversion; one-shot multivibrator; free running multivibrator (alternative circuits are given using self and mutual inductances); counting; shift register. G.A.Montgomerie

621.374.32 : 621.318.57

837 AN ELECTRONIC SUPERVISORY RELAY SENSITIVE TO VOLTAGE CHANGES. H.Maier.

Elektronik, Vol. 8, No. 10, 305-10 (Oct., 1959). In German.

A discussion, mainly theoretical, of the uses and limitations of such a relay. A.O.Stanesby

621.374.32 : 621.382.3

838 TRANSISTOR CIRCUITS FOR A FERRITE STORE. G.C.Padwick and A.L.Cain.

Proc. Instn Elect. Engrs, Paper 3027 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 16, 663-74).

Describes the various circuits associated with a coincident-current ferrite store, all of which use transistors and no valves. A switched-current pulse generator supplies the drive pulses to the store and makes use of the high-frequency power transistor type OC23. Selection is done economically by using gating matrices controlled by transistors. Junction diodes type OA10, or gold-bonded point-contact diodes type OA5, pass the current pulses in the matrices with a very small voltage drop. Two methods of gate selection and drive are described, one of which makes use of square-hysteresis-loop cores to select and drive the gating transistors, and the other uses a diode matrix to provide potential levels at the bases of the gating transistors. The output of the store is amplified by high-frequency transistors, strobed, and standardized. Provision is made for writing new information, or for rewriting information immediately it has been read, by a diode logical network controlling the "inhibit" pulse generator.

621.374.32 : 621.396.96 : 621.382.3

839 THE USE OF TRANSISTORS IN A DIGITAL CORRELATOR FOR PROCESSING RADAR INFORMATION. A.L.Cain, P.Swift and A.T.Watts.

Proc. Instn Elect. Engrs, Paper 3037 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 16, 649-56).

Describes a transistorized digital system for improving the s.n. ratio of a search radar, by correlating the responses from several successive transmitted radar pulses. The main emphasis is on the circuit techniques employed. The radar information is first quantized into 2 levels of amplitude ('0' and '1') and then into 1024 range elements each of $\frac{1}{4}$ nautical mile, i.e. 3.09 microsec. The correlation is achieved by counting the '1's stored at each range for a number of consecutive radar p.r.f. periods and deciding whether or not the results are significant. The criteria chosen for this enable the system to have an overall bearing accuracy somewhat better than the aerial beamwidth. Four separate correlation circuits are used, each handling every 4th range quantum. Thus the clock period is 12.4 microsec, which allows the use of standard magnetic-core-storage techniques. The machine is entirely transistorized and among the circuits described are: (a) a precision 323 kc/s triggered LC oscillator; (b) high-speed logical circuits using transistors and diodes; (c) a high-speed reversible counter; and (d) parts of the storage system.

621.374.32 : 621.318.13

THIN-FILM MEMORIES. See Abstr. 757

621.374.32 : 621.318.13 : 681.142

BIBLIOGRAPHY OF DIGITAL MAGNETIC CIRCUITS AND MATERIALS. See Abstr. 758

621.374.32

840 PLASTIC NEURONS AS MEMORY ELEMENTS. D.G.Willis.

I.R.E. WESCON Convention Record, Vol. 3, Pt 4, 55-65 (1959).

Neuron models have previously been proposed by various writers based upon the simple 1 bit store with feedback but although a wide variety of complex operations may be simulated using a sufficiently large number of such elements, their characteristics being time invariant a given configuration is capable of only one response to a given excitation. Estimates of the memory capacity of the human brain compared with estimates of the total neuron capacity suggest that each neuron must be capable of retaining as many as 10^6 bits of information. The plastic neuron is proposed as a first step towards such an element; it has n inputs e_i which may be (0) or (1) and one output, but each input has associated a synaptic value s_i which is a continuous variable and such that if

$$\sum_n e_i s_i \geq T,$$

where T is a threshold value, the neuron fires and gives a 1 output. The output state may be made to control the values of s_i, increasing or decreasing them by small amounts. The response of such elements then depends upon their excitation history. Examples are given of the sequential storage and subsequent recovery of a number of patterns from a plane matrix of elements. The maximum number of recoverable patterns appears to be about equal to n; above this, patterns are barely recoverable. A further example demonstrates the manner in which patterns interact and an expression is derived to show the dependence of response upon the previous history of excitation. The model has characteristics reasonably compatible with known brain behaviour and promises to become a useful tool in the study of pattern recognition problems. G.H.Stearman

621.374.4

841 THE USE OF A FRACTIONAL BI-STABLE MULTIVIBRATOR COUNTER IN THE DESIGN OF AN AUTOMATIC DISCRIMINATOR CALIBRATOR. M.W.Williard and G.F.Anderson.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 176-83 (1959).

Frequency-divider circuits are described which were originally used for generating a set of 18 frequencies simultaneously at 11 consecutive points of frequency deviation. The circuits depend on counters, built up of bistable multivibrators, arranged in binary

form with feedbacks directly or through OR devices to force an intermediate number. The output is not always taken from the end of the counter, and in this way fractional ratios may be achieved. By choosing the factors properly, the even harmonic content can be kept low. G.A.Montgomerie

621.374.42

842 A PULSE FREQUENCY-DIVIDER BASED ON A DIODE-STORAGE INTEGRATOR AND A JUNCTION-TRANSISTOR BLOCKING OSCILLATOR. V.Špány.
Sloboproudy Obzor, Vol. 20, No. 9, 565-70 (1959). In Slovak.

The circuit is used as a 5 : 1 frequency divider, the input signal being in the form of periodically repeated rectangular pulses of equal duration. The device consists of a pump circuit and a triggered blocking oscillator. The pump circuit consists of a capacitor C_1 which is followed by a parallel crystal diode; the output of this diode is fed through another diode to a capacitor C_2 which is connected to the input of the blocking oscillator (through the secondary of the oscillator transformer). When C_2 reaches a certain predetermined voltage, it is rapidly discharged by the blocking oscillator. Formulae for the design of the circuit are given. These permit the evaluation of C_2, minimum inductance of the transformer and biasing conditions of the oscillator. When followed by a scale-of-two, the above circuit can be used as a decimal divider. Four such dividers were combined to provide 1 sec pulses from a stable source working at 10 kc/s. R.S.Sidorowicz

621.374.5

843 A SYSTEM OF ANISOTROPICALLY CONDUCTING PLANES AS AN ELEMENTARY MODEL OF A DISTRIBUTED PARAMETER DELAY LINE.
Ya.D.Shirman and Z.A.Vainoris.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1368-76 (Aug., 1959). In Russian.

Works out the equations connecting frequency f and phase velocity v_ϕ for systems of two and four anisotropically conducting planes, and shows e.g. v_o/v_ϕ plotted against f for two particular cases (v_o = velocity of light in dielectric). The results are analysed in detail for very low, medium and very high frequencies. The delay in the v.l.f. case may be $\sim v_o/v_\phi = 1000$, which would correspond to only 10 in the v.h.f. case; in the case of m.f. the delay is proportional to $f^{-1/3}$. A system of two planes is suitable for a model for m.f. and only one plane may be used for v.h.f. D.E.Brown

621.374.5

844 THE BASIC THEORY OF SPIRAL DECAY LINES.
Ya.D.Shirman and Z.A.Vainoris.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1485-92 (Sept., 1959). In Russian.

Represents the spiral line as a system of two anisotropically conducting coaxial cylinders separating isotropic dielectric media with different parameters. The dispersional equation and delay are worked out and the results considered in three special cases corresponding to very low, medium, and very high frequency operation. Some numerical examples are considered. The results are compared with those for a system of anisotropically conducting planes, and the conditions for equivalence of the systems are stated. D.E.Brown

621.374.5

845 MAGNETOSTRICTIVE DELAY LINES.
P.R.Abrahamsen.
Tekn. Ukeblad, Vol. 106, No. 37, 813-18 (Oct. 8, 1959). In Norwegian.

The principles of electromagnetic delay lines with distributed and concentrated parameters are explained. Acoustic delay lines with liquid and solid media are then discussed leading to the acoustic line with medium of thin wire or tube (magnetostrictive delay line). The dependence of magnetostriction on alloy composition is shown for nickel steels, also the effect of temperature and mechanical strain upon max. magnetostriction. Data are given on an experimental magnetostrictive delay line and its application in electronic telephone exchanges with time-division multiplex is discussed. G.N.J.Beck

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AMPLIFIERS

(Abstracts on magnetic amplifiers appear also under Inductors . Reactors)

621.375.2

846 WIDE-BAND ANALYSIS OF VALVE PHASE-SPLITTING CIRCUITS. L.J.Giacoletto.
Electronic Engng, Vol. 31, 733-5 (Dec., 1959).

A phase-splitting circuit which is an electronic counterpart of a balanced output transformer has two outputs whose voltages are ideally equal in magnitude but 180° apart in phase. This ideal operation is realized at low frequencies. Interelectrode capacitances alter the output relations at higher frequencies, and it is this effect which is analysed. Accurate as well as approximate design relations are developed and compared with measured data for a typical circuit. It is found that near ideal operation to moderately high frequencies can be obtained by using suitable equal load impedances. Performance can be improved somewhat by using slightly unequal load impedances including a small peaking inductor in the anode impedance.

621.375.2

847 MULTISTAGE AMPLIFIER STABILITY.
L.G.Cripps.
Electronic Radio Engr, Vol. 36, No. 12, 454-8 (Dec., 1959).

The stability of an amplifier consisting of N cascaded stages is considered for the two cases (a) where the stability factors of all the stages are equal before cascading, and (b) where the stability factors of all the stages are equal after cascading. A short discussion of the results is given.

621.375.2 : 621.397.62

848 THE I.F. [AMPLIFIER] STAGE IN THE TELEVISION RECEIVER. II. L.F.Rocha.
Rev. Electrotec., Vol. 45, No. 6, 203-11 (June, 1959). In Spanish.

For Pt 1, see Abstr. 7338 of 1959. Stresses certain practical aspects, e.g. stray capacitance in valves and inter-stage coupling due to use of chassis as common conductor. The Miller effect is almost unavoidable and is less harmful if slightly positive, since this avoids oscillations and give a more symmetrical selectivity curve. Coupling is best carried out by 1 : 1 transformers. Phase distortion is usually greater than amplitude distortion and this should be allowed for in design. The frame grid may lead to improved performance of amplifiers, since it provides a high transconductance with a low input capacitance. N.Corcoran

621.375.222

849 CALCULATION OF A D.C. PARAPHASE TRIODE AMPLIFIER WITH COMMON CATHODE LOAD.
A.M.Imas.
Radiotekhnika, Vol. 14, No. 7, 50-5 (July, 1959). In Russian.

D.C. paraphase amplifiers have a special importance in oscilloscope applications, particularly the circuit which supplies the 2nd anode of the tube from a high-resistance centre point between the two triode anodes. An analysis of relationships between the required supply voltages, anode load resistances and the common cathode load is presented in terms of valve parameters. A.Landman

621.375.227

850 CATHODE-COUPLED PUSH-PULL OUTPUT STAGE.
K.R.Sturley and J.P.Bennett.
Electronic Radio Engr, Vol. 36, No. 11, 410-15 (Nov., 1959).

A theoretical investigation of the linear operation of the cathode-coupled push-pull output stage shows that, as the common cathode resistance Rk is increased, the ratio of the signal currents in each valve approaches unity and the output voltage is almost independent of R_k. This is confirmed experimentally and measurements of power output and distortion are obtained for different values of R_k. Power output is a maximum at a given value of R_k, but a higher value gives minimum distortion. Thompson's method of graphical analysis is shown to be applicable to the cathode-coupled stage.

621.375.23

851 THE DESIGN OF A LOW FREQUENCY SELECTIVE AMPLIFIER USING A TWIN-T BRIDGE IN A FEEDBACK PATH. S.V.Svechnikov and A.I.Petrenko.
Radioteknika, Vol. 14, No. 8, 32-9 (Aug., 1959). In Russian.

The principles and analysis are conventional. Two valves are used, one of which is a double triode. The design described would appear to give a bandwidth of about 25 c/s at a centre frequency of 1 kc/s. S.C.Dunn

621.375.4

852 ANALYSIS OF THE TRANSISTOR CASCODE CONFIGURATION. J.R.James.
Electronic Engng, Vol. 32, 44-8 (Jan., 1960).

Fixed component neutralization as used in the production of tuned amplifiers is often difficult to achieve, due to the spread in transistor parameters. A transistor cascode amplifier does not require neutralization but has less gain than two stages in the grounded-emitter configuration. The extent to which the internal feedback and gain are reduced is investigated.

621.375.4

853 TRANSISTORIZED LOG-PERIOD AMPLIFIER. E.J.Wade and D.S.Davidson.
I.R.E. Trans Nuclear Sci., Vol. NS-6, No. 2, 53-6 (June, 1959).

A log-period amplifier is described which is combined with power supply on a rack mounted chassis with a 7 in. panel. The circuits are transistorized except for electrometer tubes and log diodes. Input power is 25 W. Noise reducing and calibrating circuits are built in as well as a catching circuit to keep the log diode in its logarithmic range.

621.375.4

854 TRANSISTORIZED LINEAR PULSE AMPLIFIERS. S.C.Baker.
I.R.E. Trans Nuclear Sci., Vol. NS-6, No. 2, 57-63 (June, 1959).

The behaviour of single-stage common-emitter amplifiers is described and provides a building block with which cascaded feedback amplifiers can be analysed and designed. The problem of designing these amplifiers is complex, and what are felt to be the most important phases of the problem are discussed.

621.375.4 : 621.372.57

855 POWER GAIN AND BANDWIDTH OF TUNED TRANSISTOR AMPLIFIER STAGES.
S.Venkateswaran and A.R.Boothroyd.
Proc. Instn Elect. Engrs, Paper 3090 E [Convention on Transistors and Associated Semiconductor Devices] publ. 1960 (Part B Suppl. No. 15, 518-28).

Relationships between operating power gain and bandwidth of an active four-pole network are developed, with particular reference to single-stage tuned transistor amplifiers. The power gain is first investigated in terms of Stern's stability factor, k, the maximum gain for a given value of k being derived by analytical-numerical means without recourse to graphical procedures. It is then shown that the power gain is more fundamentally expressed in terms of a new performance factor, n, and in particular that for large values of n (corresponding to $k \gg 1$) the product of maximum power gain and n approaches an invariant, independent of the set of four-pole parameters selected for design purposes. The power gains of amplifier stages with and without unilateralizing feedback are expressed and related in terms of the performance factor, and the conditions under which the latter possibility gives higher gain are indicated. Analytical procedures and expressions for the evaluation of the bandwidth of tuned amplifier stages are presented and the conditions for maximum power gain at a given bandwidth are investigated for amplifiers with and without unilateralizing feedback. Computed results for the performance of a particular high-frequency transistor in the common-base and common-emitter configurations verify the main conclusions of the analysis and indicate the relative merits of the two configurations in regard to power gain with and without feedback applied. It is seen that for bandwidths up to a certain value a simple mismatched stage without feedback is advantageous.

621.375.4 : 621.395.44

856 TRANSISTOR FEEDBACK AMPLIFIERS IN CARRIER TELEPHONY SYSTEMS.
D.F.Burman, L.J Fey and D.G.W.Ingram.
Proc. Instn Elect. Engrs, Paper 3023 E, [International Convention on Transistors and Associated Semiconductor Devices] publ. 1960 (Part B Suppl. No. 16, 587-95).

Because equipment using transistors will be introduced into communication networks in which valve equipment is already in use, questions of compatibility will arise. In some cases the performance of transistor equipment will have to conform closely to that of existing valve equipment, whilst, in others, no such restriction will occur. With present transistors this latter case would lead to the use of low signal levels and low-gain amplifiers. With feedback amplifiers employed in carrier systems the effect is to divide the amplifiers into two classes. The first class must operate with high gains and high output power, whilst the second class is essentially one of low-power amplifiers. Examples of both classes are described, and various features of their design are discussed. These are a high-power amplifier suitable for use on an open-wire line system, a low-power wide-band amplifier for use on a system for pair cables, and a narrow-band feedback amplifier of the type used in pilot control systems. Future developments are briefly discussed.

621.375.43

857 SOME DESIGN CONSIDERATIONS FOR HIGH-FREQUENCY TRANSISTOR AMPLIFIERS. D.E.Thomas.
Bell Syst. tech. J., Vol.38, No.6, 1551-80 (Nov., 1959).

The major problem in the design of high-frequency transistor amplifiers is the interaction between the output and the input of the amplifier caused by the internal feedback of the transistor. This problem is illustrated and the two common design approaches to a solution of the problem are discussed. Nyquist's criterion of stability and Bode's feedback theory are then used to obtain an engineering evaluation of the relative merits of these two design approaches from a stability standpoint. The positive nature of the internal transistor feedback is established in this stability evaluation. Finally, Bode's feedback theory is used to consider the relative merits of some of the broad banding techniques used in transistor video amplifier design. The overall analysis shows that many of the most practical and stable linear transistor amplifiers are very simple and can be built with a minimum of design effort.

621.375.43

858 MEASUREMENT OF THE STABILITY OF TRANSISTOR FEEDBACK AMPLIFIERS. M.Pajgrt.
Slaboproudy Obzor, Vol. 20, No. 9, 542-8 (1959). In Czech.

It is shown that a multi-stage, transistor feedback amplifier can be represented by means of a quadripole whose input and output are coupled by a single feedback impedance Z. The amplification of such a system is represented by $A' = (A - A_0)/(1 - \beta A)$ where βA is the feedback vector. The measurement of βA can be effected by interrupting the feedback loop and connecting to it a source E_m through an impedance Z_m; a voltage U_β is then measured across the load of the amplifier, such that $\beta A = -U_\beta/E_m$. The impedance Z_m should be suitably chosen. Since the choice of Z_m presents some difficulty, an auxiliary measurement determining the inverse voltage transfer ratio of the amplifier can be carried out. In cases, when the feedback loop cannot be interrupted, βA can be evaluated from two open-circuit voltage measurements. R.S.Sidorowicz

621.375.9

859 ELECTRON-BEAM PARAMETRIC AMPLIFIERS. C.B.Crumly and R.Adler.
Electronic Industr., Vol.18, No.11, 73-6 (Nov., 1959).

Brief descriptions of parametric amplifiers using variable capacitance diodes and electron beams are given. The very considerable advantages of the electron-beam types in gain, bandwidth and stability are stressed and it is suggested that as the working frequency rises the use of electron beams will become even more advantageous. A.H.W.Beck

621.375.9

860 POSSIBLE LOW NOISE ELECTRON BEAM-PLASMA AMPLIFIER. J.M.Anderson.
J. appl. Phys., Vol. 30, No. 10, 1624-5 (Oct., 1959).

Draws attention to the possible use of the negative glow region of a cold-cathode discharge in obtaining low noise amplification. Most of the noise is associated with the positive column, which may be eliminated by working with the anode close enough to the cathode. Gain calculations indicate that 56 dB/cm can be obtained if a static magnetic field is used. A.H.W.Beck

621.375.9

861 PARAMETRIC AMPLIFIERS. LOW-NOISE AMPLIFICATION BY MEANS OF NON-LINEAR REACTIVE ELEMENTS. S.Toft and E.V.Sørensen.
Ingeniøren B, Vol. 68, No. 20, 585-94 (Oct. 15, 1959). In Danish.

A nonlinear reactance, positive or negative, operates as a time-varying energy source for the signals to be amplified. The basic

theory, comprised in Manley and Rowe's energy equations for nonlinear reactances is explained, and various types of nonlinear components are reviewed. Particular attention is paid to the p-n junction which acts as a voltage-dependent capacitor when biased in the reverse direction. Active diode circuits, i.e. the regenerative amplifier, the amplifying and perfectly stable parametric convertor and the conditionally stable travelling-wave amplifier are discussed. The effect of diode losses on the upper sideband convertor is considered, and data for experimental amplifiers are given.

G.N.J.Beck

MODULATION . DEMODULATION

621.376

862 OPTIMUM WORKING CONDITIONS WHEN SENDING ASYMMETRIC IMAGE SIGNALS. V.G.Alekseeva.

Radiotekhnika, Vol. 14, No. 8, 29-31 (Aug., 1959). In Russian.

The ideal frequency response in an asymmetrical sideband system includes an abrupt step in the frequency characteristics. An amplitude-frequency modulation system has been proposed by A.V.Chechnev (1953). When used with a linear discriminator a simpler system is obtained giving better resolving power than present amplitude-modulation systems. When a piecewise-linear discriminator is used the operating circuits approach ideal ones postulated by theory. The theoretical conclusions have been confirmed by experiment.

S.C.Dunn

621.376

863 ON THE PRODUCTION OF AMPLITUDE AND PHASE MODULATION. R.W.Pohl.

Z. Phys., Vol. 156, No. 3, 271-4 (1959). In German.

Two mechanical devices are described, by means of which a simple harmonic motion may be modulated in various ways. In one arrangement, one end of a thin rod is rotated by a motor drive while the other end passes through a bevelled hole in a long vertical arm. A small section of the rod is viewed through a vertical slit and the image is projected onto a screen by a polygonal mirror. With the vertical arm stationary a simusoid is traced but if the arm is oscillated from side to side about a pivot, amplitude modulation results. For phase modulation a mechanical phase shifter, or differential, is introduced in the drive. Combinations of these devices may be arranged to convert phase to frequency, or phase to amplitude modulation.

W.G.Stripp

621.376.2/.3

864 IDEAL BINARY PULSE TRANSMISSION BY A.M. AND F.M. E.D.Sunde.

Bell Syst. tech. J., Vol. 38, No. 6, 1357-426 (Nov., 1959).

In binary pulse transmission by carrier amplitude or frequency modulation it is ordinarily desirable, both for efficient bandwidth utilization and for improved performance under adverse noise conditions, to use bandpass channels of the minimum practicable bandwidth, as determined by considerations of intersymbol interference and filter design. It is shown that intersymbol interference can be avoided in binary pulse transmission by f.m. without the need for a wider channel band than in double-sideband a.m. for equal pulse transmission rates. Explicit general expressions are derived for the appropriate shaping of the bandpass channel and for the shapes of received pulses, for cases in which rectangular binary pulses are transmitted by f.m. without prèmodulation or postdetection pulse shaping by low-pass filters. Illustrative comparisons are made of binary pulse transmission by a.m. and f.m. for two special cases of general interest in communication theory and pulse-system design. The more general case of partial pulse shaping by premodulation and postdetection low-pass filters is also considered. The performance of f.m. and a.m. systems in the presence of noise depends on the division of channel shaping between transmitting and receiving filters. The optimum division with f.m. and a.m. is determined for random noise, and comparisons are made of signal-to-noise ratios for optimized f.m. and a.m. systems. It is shown that there is a single universal relation between error probability and signal-to-noise ratio, applying to an infinite universe of optimized baseband systems and optimized a.m. systems with ideal synchronous detection, and that this relation is the same as for baseband transmission over an idealized flat channel of minimum bandwidth. The analysis indicates that, with binary f.m. and appropriate postdetection low-pass filters, it is possible in principle to realize an improvement in signal-to-noise ratio over bipolar double-sideband a.m. with synchronous detection (phase reversal), for equal bandwidths, average signal power and pulse transmission rates, although this may not be feasible with practicable filters.

621.376.23

865 EXPERIMENTAL RESULTS IN SEQUENTIAL DETECTION. H.Blasbalg.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 41-51 (June, 1959).

It is shown that the Wald theory of sequential analysis agrees well with experiment for the important case of Bernouilli detection even when the excess over the boundaries at the termination of an experiment is neglected. The design of the experiments, as well as the experimental apparatus, is also discussed. Experimental curves of the operating characteristic (o.c.) and average sample number (a.s.n.) functions for several sets of parameters are given. A publication relative to the main body of this paper [Annals of Mathematical Statistics, Vol. 28, 1024-8 (Dec., 1957)] is summarized. The results of this publication are used in the addendum to study the resonant properties of the exponential class of sequential detectors. The practical use of these detectors for parameter estimation is discussed.

621.376.3

866 EXPLICIT FORM OF F.M. DISTORTION PRODUCTS WITH WHITE-NOISE MODULATION. R.G.Medhurst.

Proc. Instn Elect. Engrs, Monogr. 352E, publ. Jan., 1960, 7pp. To be published in Part C.

When a frequency-modulated wave passes through a network whose phase or amplitude characteristics vary non-linearly with frequency, distortion terms appear as both frequency and amplitude-modulation of the output wave. If the characteristics are expressed as power series, these distortion terms appear, to first order, as products of powers of time derivatives of the unwanted frequency modulation. When the frequency modulation may be simulated by a band of random noise (as in multiplex telephony carrying large numbers of channels), the spectra of the distortion products can, in principle, be described by simple algebraic functions of the characteristics (i.e. the minimum and maximum frequencies and the r.m.s. frequency deviation) of the modulating noise band. Except in certain special cases, the derivation of these algebraic formulae by straightforward analytical methods become prohibitively tedious for distortions of order much above the second. However, once the formulae are found, the insertion of numerical values for particular cases is straightforward. It is shown here how the problem can be reduced to the repetition of a number of standard operations which can be carried out using a digital computer. The technique is illustrated by application to fourth-order distortion appearing in the amplitude modulation, generated by terms in the amplitude characteristic up to sixth degree. Even in such an apparently simple case as this it appears from the literature that the closed form of the distortion formula has not hitherto been obtained. This example is of direct practical interest since, for example, the amplitude characteristic of a maximally-flat-amplitude triple-tuned circuit is of sixth degree in the region around the mid-band frequency. With a minor modification, the resulting formula also applies to fourth-order distortion appearing in the frequency modulation, owing to terms in the phase characteristic up to sixth degree. Use is made of a discontinuous contour integral applied to a similar, but somewhat simpler, case by Bennett; [Bell. Syst. tech. J., Vol.19, 587 (1940)] a closely analogous course can be followed using the more recently developed theory of generalized functions, but in this particular problem the contour-integral method is more economical. Formulae for the various orders of distortion in the top channel due to amplifier and discriminator characteristics are given in tabular form.

621.376.332

867 TRANSIENT PROCESSES IN AUTOMATIC FREQUENCY CONTROL SYSTEMS USING FERRITE AS THE CONTROLLING ELEMENT. V.I.Kaganov.

Radiotekhnika, Vol.4, No.8, 57-62 (Aug., 1959). In Russian.

The second-order differential equation for the transient stats, as it includes the non-linear discriminator characteristic, is impracticable of solution except by approximate methods. A solution is obtained by a method in which the deviation from an exact solution can be estimated. In tests at 16 Mc/s, agreement between experimental and calculated results was satisfactory.

F.Quelon

621.376.53

868 A MILLIMETRE RANGE FERRITE SQUARE WAVE MODULATOR. Khuan U-Khan' [Huang Wu-Hang]. Sci. Record, New Series, Vol. I, No. 6, 405-10 (Dec., 1957). In Russian.

Describes the operating principle whereby the Faraday effect in an Mn-Mg ferrite is utilized to rotate the plane of polarization of an 8 mm wave by 90°. The necessary magnetizing current is supplied by a pulse generator, the value of the current needed for 90° rotation being obtained from experimental Faraday-effect curves for the ferrite in question. By using a suitable waveguide combination, transmission of the 8 mm wave is effectively switched on and off by the pulse. The circuit diagram of the pulse generator is included, and reproduced oscillograms of modulation and detected mm output refer to repetition frequencies of 300, 400, 500 c/s. Advantages claimed are the small pulse current needed for 100% modulation, and simplicity. D.E.Brown

621.376.56

869 A PULSE-CODE MODULATOR USING JUNCTION TRANSISTORS. A.J.Armstrong. Proc. Instn Elect. Engrs, Paper 3088 E [International Convention in Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 16, 571-6).

Describes a pulse-code modulator, using junction transistors, designed to provide a 5-digit transmission of a signal having a total bandwidth of 800 c/s. The system described uses the pulse-count method as being the most straightforward way of producing a digital code from an a.c. waveform. A monitor unit is included to decode any required number of digits of the output signal so that system-evaluation tests can be carried out. Temperature tests are also described, the results of which show that the equipment will operate satisfactorily up to a temperature of at least 65°C.

ELECTRONICS

SEMICONDUCTOR MATERIALS AND DEVICES

TRANSISTORS

621.382 : 621.376.32 : 621.317.79

870 THE DESIGN AND PERFORMANCE OF A HALL-EFFECT MULTIPLIER. R.P.Chasmar, E.Cohen and D.P.Holmes. Proc. Instn Elect. Engrs, Paper 2982 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 16, 702-5).

The construction of a Hall-effect multiplier is described and such design features as linearity, frequency response, temperature stability and circuit considerations are discussed. Suggestions are made as to possible uses for this device.

621.382 : 621.316.925.451

AN EXPERIMENTAL IMPEDANCE RELAY USING THE HALL EFFECT IN A SEMICONDUCTOR. See Abstr. 698

621.382 : 621.317.794 : 539.12

871 A SEMICONDUCTOR DEVICE FOR FAST- AND SLOW-NEUTRON DOSIMETRY. C.A.Klein and W.D.Straub. Proc. Instn Elect. Engrs, Paper 2986E [International Convention on Transistors and Associated Semiconductor Devices] publ. 1960 (Part B Suppl. No. 16, 706-13).

Quantitative observations of pile-neutron effects in germanium and silicon suggest their use as fast-neutron dosimeters, especially in mixed neutron-γ fields. In order to provide a firm basis for such techniques, or, in other words, to determine neutron-response characteristics of semiconductor materials for general dosimetry applications, more information is needed on the extent to which the damage is actually energy dependent. In the present state of the art, the development of semiconductor dosimeters for fast neutrons of known energy spectrum should be rewarding. On the other hand, it is well known that thermal-neutron captures by lattice nuclei have only a small effect on the electrical properties of germanium or silicon crystals. Slow-neutron reactions yielding fast charged particles or ions may result in enhanced, highly localized damage of practical interest for thermal-neutron dosimetry. A suitable arrangement combining a high-resistivity p-type germanium foil with thin linings of lithium-6 appears to be a convenient tool for the estimation of biologically significant thermal-neutron doses. Analytical and experimental work done on semiconductor dosimeters designed according to the above-mentioned lines is presented.

621.382.2

872 THE TUNNEL DIODE — ITS ACTION AND PROPERTIES. B.Sklar. Electronics, Vol. 32, No. 45, 54-7 (Nov. 6, 1959).

Presents a simplified, clear, description of the mechanism of the Esaki diode. F.F.Roberts

621.382.2 : 621.791.7

COLD PRESSURE-WELDING AND ITS INFLUENCE ON DEVICE DESIGN AND MANUFACTURE. See Abstr. 617

621.382.2 : 621.316.91

873 THE PROBLEMS OF OVERVOLTAGE IN CIRCUITS WITH GERMANIUM DIODES AND PROTECTION AGAINST OVERVOLTAGE. V.Husa, J.Cihelka and L.Černý. Elektrotech. Obzor, Vol. 48, No. 9, 478-82 (1959). In Czech.

Explains briefly the reason for the current surge when the voltage changes into the reverse direction. The consequent overvoltage across the diode is determined by analyzing the circuit, which for protection includes, in parallel with the diode, a capacitor and a resistor in series. The value of the resistor for the smallest overvoltages is calculated, assuming resistive, or inductive loads. Fair agreement is found with experimental results, which are shown in graphs and oscillograms. N.Klein

621.382.2/3 : 537.311 : 539.2

874 INVESTIGATION OF THE TEMPERATURE VARIATION OF NOISE IN DIODE AND TRANSISTOR STRUCTURES. C.A.Lee and G.Kaminsky. J. appl. Phys., Vol.30, No.12, 1849-55 (Dec., 1959).

Measurements of the white noise of transistors (principally, diffused-base structures) and diodes have been made at temperatures ranging from about 77° to 300°K for a range of about two decades in injection level, and from 10 kc/s to 10 Mc/s. Comparisons of the noise measurements with calculated levels are presented. The germanium transistors show a progressively increasing deviation from the theory as the temperature is decreased, and most of the silicon transistors exhibited excess white noise at room temperature and below.

621.382.23 : 537.311 : 539.2

875 SURFACE-DEPENDENT LOSSES IN VARIABLE REACTANCE DIODES. D.E.Sawyer. J. appl. Phys., Vol. 30, No. 11, 1689-91 (Nov., 1959).

Surface effects may seriously degrade the performance of a semiconductor junction diode used as a variable reactance element without significantly degrading the diode's d.c. characteristics. Measurements on both p^+n and n^+p germanium alloy junction diodes have yielded a diode series equivalent resistance component in excess of the calculated integrated bulk resistance. This excess resistance decreased with frequency approximately as 1/f and for freshly etched devices could be varied by changing the atmosphere surrounding the diode. Those ambients which yielded a maximum surface-determined junction breakdown voltage also yielded a maximum frequency-dependent excess resistance. A model which can explain these observations assumes a surface inversion layer contiguous with the alloy junction.

621.382.23 : 537.311.33 : 539.1.07

876 GOLD-GERMANIUM JUNCTIONS AS PARTICLE SPECTROMETERS. J.M.McKenzie and D.A.Bromley. Proc. Instn Elect. Engrs, Paper 2992 [International Convention on Transistors and Associated Semiconductor Devices] publ. 1960 (Part B Suppl. No. 16, 731-4).

Gold–germanium p-n junctions for the detection of α-particles and fission fragments are reported in the references. The present investigation, using protons, deuterons, α-particles and He^3 ions, shows that the output pulse is proportional to the incident energy,

providing the particle range does not exceed the effective junction thickness. Measurements on the maximum pulse heights obtainable from protons and deuterons agree on the effective junction thickness; however, the exact value varies with method and conditions of manufacture and increases with the voltage across the junction. The output pulse height is not dependent on the type of particle provided the junction bias is maintained above the minimum value (about 1 volt) required to prevent recombination. The pulse height is independent of crystal temperature if the voltage on the crystal is fixed, but as the temperature decreases the signal/noise ratio increases. At liquid-nitrogen temperature the resolution of 5 MeV α-particles (2-3%) is not determined by the signal/noise ratio. A value of 2.84 ± 0.12 eV, in accord with that previously reported, has been found for the energy required to produce an electron-hole pair in germanium. Pulse rise times have been shown to be less than 3 millimicrosec and are believed to be much shorter than this. Applications of these detectors in charged-particle spectroscopy are discussed.

621.382.23 : 621.375.9

877 GERMANIUM DIODES FOR PARAMETRIC AMPLIFIERS. S.N.Ivanov, N.E.Skvortsova and Yu.F.Sokolov.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1538-42 (Sept., 1959). In Russian.

Formulates the basic requirements of semiconductor diodes in such amplifiers (where the p-n junction capacity in the negative bias region is the variable reactive parameter) and developes a simple approximation method for calculating the specific resistances, contact area and crystal thickness of the diode. An experimental diode based on this method is described; it enables amplification to be obtained in the cm region in parametric regeneration systems. D.E.Brown

621.382.23

878 CHOICE OF SEMICONDUCTOR DIODES. P.Svedberg.
Tekn. T., Vol. 89, No. 36, 949-51 (Oct. 2, 1959). In Swedish.

The main physical properties of Si and Ge diodes are compared in a table and construction and frequency characteristics are considered briefly. Constancy of physical properties in varying environments depends upon quality of the sheathing. A sheathing tightness test developed by the Swedish Institute for Semiconductor Research has proved very effective in rejecting faulty samples. It consists of 10 thermal cycles between -78° and 100°C, followed by 5 weeks' storage at 55°C in 100% relative humidity. 1000 diodes after surviving this test ran for 2 years without failure. It is recommended that diodes be chosen from manufacturers who have a thorough testing programme. G.N.J.Beck

621.382.23 : 621.383

879 MEASUREMENTS OF THE NOISE SPECTRA OF GERMANIUM JUNCTION PHOTODIODES IN A WIDE FREQUENCY RANGE. T.M.Lifshits, and L.Ya.Pervova.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1543-8 (Sept., 1959). In Russian.

Describes, with circuit diagram, noise spectrum measurements in the range 2×10^{-3} to 2×10^{4} c/s by the magnetic-tape recording method, the low frequencies being transformed to audio frequencies by changing the tape speed. The photodiode spectral noise density is shown to preserve the form $1/f^{m}$ with constant index m close to unity throughout the range concerned. D.E.Brown

621.382.232

880 P–N TRANSITION OF GERMANIUM. L.Černý, V.Husa, J.Kříž and J.Ladnar.
Elektrotech.Obzor, Vol.48, No.8, 406-9 (1959). In Czech.

Compares the simple diode and diffusion theories of p–n junctions. Experimental results confirm the exponential current–voltage relation in the reverse direction, but the temperature-dependence of the voltage, at which saturation current is obtained, is not explained by the simple theories. Copper impurities in indium electrodes cause a linear component in the reverse current. Discusses various technological points, especially those important for the decrease of scatter in the characteristic and gives some details of production. N.Klein

621.382.3

881 THEORY OF TRANSISTOR GAIN AND CARRIER DISTRIBUTION IN THE BASE. J.Della Riccia.
Ann. Radioelect., Vol. 14, 366-74 (Oct., 1959). In French.

Restates the theory of the current-dependence of current gain, particularly at high currents, and shows that good match to experimental data can be obtained and that, knowing the geometry of the device, the emitter doping concentration and the surface recombination velocity may be inferred from the data. F.F.Roberts

621.382.3

882 COOLING POWER TRANSISTORS. S.Stern.
Electronic Industr., Vol.18, No.9, 77-82 (Sept., 1959).

Presents curves of transistor case hot-spot temperature-rise above inlet air temperature as a function of air flow rate and transistor power dissipation for 6 arrangements of heat sink and air flow. Some data on air pressure drop and cooling power are included. F.F.Roberts

621.382.3

883 SOME NOTES ON THE OUTPUT CAPACITANCE OF TRANSISTORS. D.H.Jones and J.R.Tillman.
Proc. Instn. Elect. Engrs, Paper 3102E [Convention on Transistors and Associated Semiconductor Devices] publ. 1960 (Part B Suppl.15, 490-3).

Some brief examinations are made of the influence of base resistance, emitter termination, bias conditions and frequency on the output capacitance of transistors with uniform base resistivity, by way of physical considerations, equivalent circuits and 4-pole parameters.

621.382.3

884 SOME FEATURES OF TRANSISTOR TRANSIENT CHARACTERISTICS WITH SMALL SIGNALS. K.Ya.Senatorov and A.I.Gomonova.
Radiotekhnika i Elektronika, Vol. 4, No. 7, 1153-63 (July, 1959). In Russian.

Investigates theoretically and experimentally the initial part of the transient characteristic in a transistor as a function of the emitter bias current. Oscillograms, experimental curves etc. are reproduced mainly for the P2B transistor in the earthed base connection. With no bias or very small ($< 5\,\mu$A) bias current the emitter junction time-constant plays the chief role in the transient process, whilst the diffusion process is of secondary importance. The results are compared with those of earlier authors. D.E.Brown

621.382.3 : 621.396.96 : 621.374.32

USE OF TRANSISTORS IN A DIGITAL CORRELATOR FOR PROCESSING RADAR INFORMATION. See Abstr. 839

621.382.3

885 THE SATURATION STATE IN JUNCTION TRANSISTORS. K.S.Rzhevkin and V.I.Shveikin.
Radiotekhnika i Elektronika, Vol. 4, No. 7, 1164-72 (July, 1959). In Russian.

Evaluates the resolution time of minority carriers in the base with an arbitrary length of input current pulse for the earthed-base and earthed emitter configurations. Measurements on transistors type P6B, P6G, P1A, P6D (with emitter currents in the range 0.2 to 20 mA) provide experimental verification. Illustrations include the minority carrier lifetime as a function of emitter current, and minority carrier resolution time as a function of input pulse length. D.E.Brown

621.382.32 : 621.374.32

886 THE TRINISTOR SWITCH–A SOLID-STATE POWER RELAY. P.F.Pittman.
I.R.E. Trans Nuclear Sci., Vol. NS-6, No. 2, 69-73 (June, 1959).

The Trinsistor switch is a new semiconductor device which can be used to provide control of large amounts of load power. Its characteristics are similar to those of a thyratron because it will either absorb a high voltage and prevent the flow of load current or break over to a low voltage and allow load current to flow. A third terminal can be used for the application of a control current which initiates this breakover action. Switching efficiency is quite high because the device can block a voltage of several hundred volts at a few milliamperes leakage or conduct 50 A at a voltage drop of 1.0 V. The switch can be used to control either a.c. or d.c. with a minimum of associated circuitry. This device can be used in place of relays or other switching devices to provide contactless switching in circuits which have a minimum of weight and require a minimum of space.

621.382.333

887 VARIATION OF INPUT CONDUCTANCE OF A GROUNDED BASE JUNCTION TRANSISTOR.
S.Deb and J.K.Sen.
Electronic Engng, Vol. 31, 753-5 (Dec., 1959).

Investigates the problem of variation of input conductance of a grounded-base junction transistor with the input d.c. current. Methods are suggested for maintaining this variation linear over a wide range of values of current and also for reducing the thermal drift. Performances of an amplitude modulator and an analogue multiplier using a transistor incorporating these features are described.

631.382.333

888 STATIC CHARACTERISTICS OF JUNCTION TRANSISTORS UNDER PULSED CONDITIONS. J.Budínský.
Slaboproudy Obzor, Vol. 20, No. 9, 570-7 (1959). In Czech.

It is pointed out that in pulse applications the static characteristics of a junction transistor should be defined in the following three regions: (1) the emitter and collector are reverse-biased, the transistor being inactive; (2) the emitter is forward-biased and the collector is reverse-biased (the transistor is active); (3) the emitter and collector are forward-biased, the transistor being inactive. Characteristics in the three regions are discussed in detail; in particular, conditions of thermal stability are investigated. It is shown that operation of a transistor in the three regions can be described by the Ebers–Moll equations (see Abstr. 937 of 1954). The specification of transistors for pulse applications should contain the following information: (1) zero collector and emitter currents at several voltages; (2) base–collector breakdown voltage; (3) emitter–collector breakdown voltage; (4) d.c. amplification factors at several collector currents; (5) maximum permissible base, collector, and emitter currents; and (6) the maximum power dissipation.

R.S.Sidorowicz

621.382.333.3 : 621.374.32

889 P-N-Π-N TRIODE SWITCHING APPLICATIONS.
V.H.Grinich and I.Haas.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 108-13 (June, 1959).

The characteristics and switching applications of a developmental diffused silicon p-n-π-n triode are discussed. Although this unit is at present in a two-watt package, it is capable of handling short pulses of current of the order of 100 A. The electrical characteristics which consist of a low and high conductivity region (over 500 MΩ and less than 1 Ω respectively), with an intermediate negative resistance region, are controllable by the base lead, and hence make it a flexible device for applications in the computer and communications fields. Theoretical and practical limitations are discussed. Experimental data covering current handling capabilities, frequency limitations and switching times are presented in conjunction with representative circuits. Two particular circuits discussed are an 80 A 500 mμs pulse generator with rise and fall times in the order of 150 mμs and 300 mμs respectively, that can operate up to a kilocycle repetition rate, and a 4 A 60 mμs pulse generator with a p.r.f. of 100 kc/s. Other examples described included monostable, bistable, and astable circuits, as well as types of communication circuitry for a wide range of currents.

PHOTOELECTRIC DEVICES

621.383.2.032.35

890 ELECTROLUMINESCENT CELL APPLICATIONS.
R.B.Lochinger and M.J.O.Strutt.
Electronic Radio Engr, Vol. 36, No. 11, 398-406 (Nov., 1959).

The efficiency of some types of electroluminescent (El) cells (i.e., the ratio of the power transformed into visible light to the electrical input power) was measured at various frequencies. Some oscillator circuits were investigated with negative results. The time constants of some photoconductors were investigated theoretically and experimentally. A combination of El-cells and photoconductors was successfully applied to obtain a demodulation-amplifier circuit. The basic circuit combinations of El-cells and photoconductors were investigated experimentally and theoretically. These were successfully applied to obtain self-oscillating multivibrators as well as bistable flip-flop circuits.

621.383.27

891 TRANSIENT CHARACTERISTICS OF PHOTOMULTIPLIERS. G.A.Vasil'ev.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1377-80 (Aug., 1959). In Russian.

Discusses the possibility of describing the photomultiplier time characteristics by means of the transient characteristic h(t):

$$h(t) = A(t) + \frac{1}{T}\int_0^t A(\xi)d\xi$$

where A(t) = oscillogram of scintillation pulse, i.e. the photomultiplier reaction to light excitation of the form exp(−t/T), where T = scintillator constant. Experimental data obtained by micro-oscillograph are quoted for multipliers type FEU-19, 22, and 1B.

D.E.Brown

621.383.4

892 PHOTOELECTRIC RESISTORS OF SINTERED CADMIUM SULPHIDE. J.Kubátová.
Slaboproudy Obzor, Vol. 20, No. 9, 556-9 (1959). In Czech.

The resistors were prepared from copper-activated CdS powder (1 mg for 1 g CdS). The powder was thermally processed at 550–650°C for 15 to 60 min. The resulting substance was cut into rectangular slabs having a thickness of a few mm, length of up to 40 mm and width of 6 mm. The slabs were then furnished with a pair of electrodes. The elements so obtained have the following characteristics: (a) maximum sensitivity at 600 mμ; (b) operating voltages up to 300 V; (c) dark currents of the order of 30 mμA; (d) operating currents of the order of 1 mA; (e) linear dependence between the illumination and the output current; (f) relaxation time of the order of 1 ms, and (g) maximum dissipation of 0.5 W.

R.S.Sidorowicz

621.383.8

893 RADIATION EFFECTS IN SILICON SOLAR CELLS.
F.A.Junga and G.M.Enslow.
I.R.E. Trans Nuclear Sci., Vol. NS-6, No. 2, 49-53 (June, 1959).

Calculations have been performed to estimate the number of atoms displaced from normal sites by Compton electrons from Co^{60} gamma rays and by slow and fast neutrons. The resultant change in carrier lifetimes and mobilities are used to predict the performance of a silicon solar cell under gamma and neutron irradiation. The effect of annealing of defects is considered, and from these computations an estimate is made to show the minimum flux necessary to produce noticeable damage. Data are presented showing the effects of Co^{60} gamma rays on 10 silicon solar cells and comparison is made with the theory.

ELECTRON TUBES

621.385.1

894 THE CONDUCTIVITY OF OXIDE CATHODES. VIII. CURRENT-DEPENDENT MATRIX DISSOCIATION.
G.H.Metson and E.MaCartney.
Instn Elect. Engrs, Monogr. 357E, publ. Feb., 1960, 5pp. To be republished in Part C.

For Pt VII, see Abstr. 7426 (1959). In the present Part an attempt is made to determine the nature of the dissociative action which accompanies the passage of a current through a barium-strontium-oxide matrix at 1 020°K. Two identical oxide systems operating at a common temperature and passing the same quantity of electricity but at different rates might be expected to suffer the same mass of oxide dissociation. Experiment shows, however, that such is not necessarily the case and that dissociation mass is determined by rate of application of electricity rather than by the total quantity of electricity. The products of dissociation are shown to be in ionic form, and experimental arrangements are made for the separate collection of the ions in chemical form on a relatively massive scale. A working hypothesis is offered in explanation of the experimental observations.

621.385.1

895 NOISE PARAMETERS IN V.H.F.-U.H.F. CIRCUIT DESIGN. C.Metelmann.
Electronic Industr., Vol. 18, No. 7, 90-3 (July, 1959).

A method of calculating the lowest possible tube noise figure

and optimum source resistance for a wide range of frequencies from measurements of the noise parameters is described. Data calculated for typical tubes are given. R.C.Glass

621.385.1 : 533.5

896 ALL-METAL BAKEABLE TAPS FOR HIGH VACUUM. N.W.Robinson.

Electronic Engng, Vol. 31, 759-60 (Dec., 1959).

In an increasing number of microwave and image intensifier tubes it is becoming necessary to create vacuums of the order of 10^{-10} mm Hg. This may be accomplished by a system described by Alpert [Abstr. 8274 A (1953); J. appl. Phys., Vol. 24, 860-76 (July, 1953)]: in this system a greaseless isolating tap is a necessary component. In this article a suitable all-metal bakeable tap is described and its performance enumerated.

621.385.1.029.6

897 MICROWAVE TUBES — AN INTRODUCTORY REVIEW WITH BIBLIOGRAPHY. A.F.Harvey.

Proc. Instn Elect. Engrs, Monogr. 343, publ. Sept., 1959, 31 pp. To be republished in Part C.

Reviews the various types of electron vacuum tubes employed for amplification and generation at microwave frequencies. Emphasis is placed on principles of operation and on tubes recently developed to give high power output, oscillations at the highest frequencies and low noise factors. The treatment is restricted to conventional tubes in which the output energy is derived from the d.c. input. The subject is interpreted in terms of published work, the text being closely associated with a bibliography which is complete up to the Microwave Valve Convention of May, 1958. After a general introduction, the first part discusses grid-controlled tubes. It is then shown how the interaction of space-charge waves with resonant cavities and slow-wave circuits results in the various forms of drift-space and growing-wave tubes. The second part deals with crossed-field interaction in planar and circular geometry and includes an examination of the magnetron. An account is given of novel methods of generation of submillimetre waves and the usual sources of electrons are described. The third part analysis noise phenomena in oscillators and amplifiers.

621.385.4

898 ENERGY RELATIONS OF TETRODE U.H.F. GENERATORS. V.S.Mikhailov.

Radiotekhnika, Vol. 14, No. 9, 19-24 (Sept., 1959). In Russian.

Electronic phenomena in the region between the anode and screen grid are analysed at u.h.f., when the inertia of electrons has to be taken into account. The case is considered when the screen voltage is lower than the d.c. anode voltage. Formulae are worked out for analysis of operation of the tetrode working as a power amplifier, frequency-multiplier or amplitude modulator. A.Woroncow

621.385.622.3

899 THE ENERGY CHANGES OF A PARTICLE OR SYSTEM UNDER THE ACTION OF EXTERNAL FORCES. V.I.Gaiduk.

Radiotekhnika i Elektronika, Vol. 4, No. 9, 1513-26 (Sept., 1959). In Russian.

The total energy of a particle or system of particles changing in time under the action of externally impressed non-conservative forces is shown to be directly determinable from the solution of a system of first-order differential equations. It is not necessary here to find as a preliminary the particle co-ordinates as functions of time from the equations of motion. With small external excitations, well developed methods can be used for constructing an approximate solution. The general mathematical approach here outlined is illustrated by reference to the interference of electrons and r.f. oscillations in a strophotron. In the case of complex particle motion the transformation described for the equations of motion (Lagrange equations) is suitable for finding not only the particle energy but also the approximate laws of motion. D.E.Brown

621.385.623.5

900 DETERMINATION OF THE COEFFICIENT OF PHASE ABERRATION IN A REFLEX KLYSTRON. J.Bonnerot.

C.R. Acad. Sci. (Paris), Vol. 249, No. 20, 2023-5 (Nov. 16, 1959). In French.

The variation in the bunching parameter over the radius of the beam was studied by equipotential plots. It was found that the ratio of the actual h.f. current to that calculated from the simple Webster theory was only 0.36 for the case studied. A.H.W.Beck

621.385.624

901 NETWORK ANALOGUE FOR THE SYNTHESIS OF MULTICAVITY KLYSTRONS. K.Bløtekjaer.

Elektrotek. T., Vol. 72, No. 29, 413-17 (Oct. 15, 1959). In Norwegian.

Synthesis of klystrons with a prescribed frequency response is almost impossible when the number of cavities exceeds four or five, owing to coupling between non-adjacent cavities. A method of synthesis based on a transmission line analogue of the klystron is described. The line voltage and current of a signal propagating on a transmission line loaded directly with resonant circuits are closely analogous to the v.f. beam velocity and v.f. beam current propagating in the electron stream in a klystron amplifier. An analogue circuit is described, which enables klystrons with any number of cavities to be designed. The measuring circuit is operated at 500 kc/s and permits the ratio of the two voltages corresponding to those existing across the first and last cavities to be determined. Using a sawtooth signal which feeds the X-plates of an oscillograph and simultaneously modulates an f.m. oscillator which in turn feeds the Y-plates via the analogue and a proportional meter and convertor, a continuous record of the band-pass curve is obtained on the oscillograph. G.N.J.Beck

621.385.632.1

902 DETERMINATION OF THE ELECTROMAGNETIC WAVE PROPAGATION CONSTANTS IN DELAY SYSTEMS IN THE PRESENCE OF AN ELECTRON BEAM. Yu.N.Pchel'nikov.

Radiotekhnika i Elektronika, Vol. 4, No. 9, 1493-8 (Sept., 1959). In Russian.

Points out that the propagation constants of t.w. tubes are defined by 3 equations, one of which is transcendental. The transcendental equation is here reduced to algebraic form by Taylor expansion up to second order terms of the functions concerned (assuming sufficiently small current densities). The algebraic characteristic equation hence obtained is applied to 3 simple examples, including the waveguide model of a t.w. tube. D.E.Brown

621.385.632.1

903 CALCULATION OF THE NOISE FIGURE OF A TRAVELLING-WAVE TUBE. P.Štark.

Slaboproudy Obzor, Vol. 20, No. 9, 560-4 (1959). In Slovak.

It is assumed that the noise wave in a travelling-wave tube can be represented by an electric wave which propagates in a non-uniform lossless transmission line. The flow of electrons in the beam of the tube is assumed to be laminar and their velocities are equal. An equation for the noise figure F of the tube is derived. This expresses F in terms of cathode temperature, electrical characteristics and constructional parameters of the tube. The equation is employed to evaluate a minimum value of F. The procedure of calculating F at a given frequency is explained in detail and a numerical example is given. It is pointed out, that before carrying out the calculation, it is necessary to determine experimentally (by means of a model) the potential distribution between the cathode and input of the helix. Calculated results differ from experimental values by less than 1.5 dB. R.S.Sidorowicz

621.385.632.12

904 A 10 W TRAVELLING-WAVE TUBE FOR THE 75 cm BAND. C.T.De Wit.

Tijdschr. Ned. Radiogenoot, Vol. 24, No. 2-3, 89-100 (1959). In Dutch.

A tube has been developed for converting a large proportion of the electron beam energy into h.f. energy. The amplification is given by $G = -9.54 + 47.3\,CN$ dB, where $C^3 = KI_0/4V_0$, K being the mutual (electron-field) impedance, I_0 and V_0 the beam current and voltage respectively; N is the number of wavelengths in the active part of the spiral. The design of the helix, electron gun and magnet system are described in detail. The tube can be used for short-distance radar (λ = 4 and 8 mm) with high resolving power. G.N.J.Beck

621.385.632.12

905 TRAVELLING-WAVE TUBES WITH LOW NOISE FACTOR. A.Versnel.

Tijdschr. Ned. Radiogenoot., Vol. 24, No. 2-3, 101-12 (1959). In Dutch.

The design of low-noise t.w.t.'s is considered theoretically from three standpoints: the behaviour of the fluctuations in the diode space formed by the cathode and the acceleration anode, their

behaviour in the drift space between the acceleration anode and the start of the transmission line (helix), and lastly in the helix space in which the fluctuations interact with the incoming h.f. wave from the aerial. G.N.J.Beck

621.385.633 : 621.316.726

906 STABILIZATION OF THE FREQUENCY OF A HIGH-POWER CARCINOTRON.

J.Hervé, J.Pescia and M.Sauzade.
C.R. Acad. Sci. (Paris), Vol. 249, No. 16, 1486-8 (Oct. 19, 1959).
In French.

Stabilization is achieved by altering the sole voltage, which gives a frequency change of about 1 Mc $sec^{-1}Volt^{-1}$. The instantaneous frequency is compared with the frequency of a cavity in a magic tee circuit. A crystal is used to modulate the system at 30 Mc/s. Large amounts of amplitude modulation can be achieved without consequent frequency changes. A.H.W.Beck

621.385.633

907 AN EXPERIMENTAL INVESTIGATION OF THE BACKWARD WAVE SPIRATRON.

G.A.Bernashevskii and T.A.Novskova.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1499-504 (Sept., 1959).
In Russian.

Describes measurements on an experimental spiratron (10 cm) with centrifugal electrostatic focussing. A tuning range of 30% of mid-frequency was obtained by changing one spiral voltage (2600 to 3520 Mc/s for 620 to 1320 V change), whilst changing 2 voltages gave a range of 11.5 to 6.7 cm (1 : 1.7). Maximum power output was 50 mW. Two types of oscillation were observed, the one in line with present backward-wave tube theory and the other evidently bound up with particular electron optics of the spiratron and not explained by present theory. A sketch of the device and numerous experimental curves are included. D.E.Brown

GAS DISCHARGES
GAS-DISCHARGE TUBES

621.387

908 THE CHARACTERISTICS AND APPLICATIONS OF CORONA STABILIZER TUBES.

E.Cohen and R.O.Jenkins.
Electronic Engng, Vol. 32, 11-15 (Jan., 1960).

The corona discharge used for voltage stabilization takes place in hydrogen between a cathode cylinder and an axial wire anode. Apart from thermal effects which become significant in higher voltage tubes the discharge behaves approximately as a constant voltage in series with a resistance. These two parameters depend on the electrode radii and the gas pressure. The characteristics of tubes with subminiature, B7G and B9A envelopes covering a range of 350 V to 7 kV are given. The tubes are suitable for operation in circuits supplying currents in the range of 0.02 to 1 mA and various applications are outlined.

621.387 : 537.534

909 THE ENERGY DISTRIBUTION OF IONS FROM A HIGH-FREQUENCY SOURCE. E.T.Kucherenko and A.G.Fedorus.
Radiotekhnika i Elektronika, Vol.4, No.8, 1233-7 (Aug., 1959).
In Russian.

Describes the experimental quartz discharge chamber in which excitation of the h.f. discharge (60 Mc/s) may be capacitative or inductive. The energy spectra were measured by the cylindrical capacitor method, with a resolution $U/\Delta U > 100$, and the results compared with the energy distribution functions of ions leaving an h.f. discharge without an extraction device. D.E.Brown

621.387 : 537.52

910 CHECKING THE APPLICABILITY OF THE PROBE METHOD TO THE MEASUREMENT OF THE CHARGE CONCENTRATION IN A HIGH-FREQUENCY DISCHARGE.

S.M.Levitskii and I.P.Shashurin.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1238-43 (Aug., 1959).
In Russian.

Describes comparative measurements of electron concentrations in d.c. or r.f. discharges (frequency 0.7 to 68 Mc/s) by using single probe, double probe, and cavity resonator methods. Assuming that the resonator method yields the true figures, it can be concluded that the single probe method is suitable for h.f. discharge measurements, whilst the double probe method should only be used when special factors make the single probe method impracticable. D.E.Brown

621.387 : 537.52

911 FEATURES OF ELECTRON OSCILLATION DISCHARGES IN A MAGNETIC FIELD.

E.T.Kucherenko and O.K.Nazarenko.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1253-6 (Aug., 1959).
In Russian.

Establishes the existence of two discharge states on varying the magnetic field. The first state is excited with H_2 pressures $< 2 \times 10^{-3}$ mm Hg and fields ~ 50 Oe. The second (arc) state is excited at H_2 pressures $> 2 \times 10^{-3}$ mm Hg and fields from a few hundred to ~ 1000 Oe. The work is of a preliminary nature. D.E.Brown

621.387

912 ELECTROSTATIC CONTROL OF THE FIRING OF A GLOW DISCHARGE TUBE.

G.E.Makar-Limanov and Yu.Ya.Metlitskii.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1274-7 (Aug., 1959).
In Russian.

Describes briefly and illustrates control characteristics of experimental glow discharge tubes in which the molybdenum cathode and plane anode are separated by one or two auxiliary electrodes and one or two control electrodes, interelectrode spacing being from 0.1 to 2 cm. The control voltage affects the propagation of the cathode–auxiliary electrode discharge to the anode. The method is said to be a practical proposition offering stable firing control. D.E.Brown

621.387

913 OSCILLATIONS ON A SMALL ANODE AS A MEANS OF MEASURING VAPOUR OR GAS DENSITIES.

A.V.Rubchinskii, F.S.Kobelev and V.M.Mantrov.
Radiotekhnika i Elektronika, Vol. 4, No. 8, 1311-15 (Aug., 1959).
In Russian.

Describes practical applications of the relationship between the amplitude of the voltage oscillation on a tungsten or molybdenum anode (0.01-2 mm diam, a few mm long) in a low pressure discharge and the gas or vapour density. Calibration curves are given for small anodes in mercury vapour, H_2 and inert gas. The method of displaying the vapour density in gas-discharge devices in the reverse and direct half-cycles on an oscilloscope is indicated. D.E.Brown

621.387

914 CONTRIBUTION TO THE THEORY OF THE CATHODE FALL. I.Popescu.
Rev. de Physique [Bucarest], Vol. 4, No. 2, 211-19 (1959).
In French.

In the regime of abnormal glow, most of the ions reaching the cathode are formed in the negative glow. It is shown that the ionization in the dark space is quite unable to maintain the discharge. A.H.W.Beck

ELECTRONIC EQUIPMENT

621.389

915 AN AUTOMATIC CAMERA CONTROL.

H.R.A.Townsend.
Electronic Engng, Vol. 31, 736-9 (Dec., 1959).

A miniature cold-cathode tube used to control a multi-contact relay forms a versatile unit with which to build a process controller. The camera control described incorporates a simple delay circuit, a synchronizing circuit and a remote firing circuit, as well as a binary counter also constructed with miniature cold-cathode tubes. It performs the relatively complex sequencing needed for fully automatic photography of traces displayed on a cathode-ray oscilloscope.

621.389

916 3-D PACKAGING REDUCES SIZE OF ELECTRONIC UNITS. E.C.Hall and R.M.Jansson.
Electronics, Vol. 32, No. 41, 62-5 (Oct. 9, 1959).

3-D, or high-density electronic packaging, consists of mounting and wiring circuit components in a miniature three-dimensional unit mass. Circuit elements are placed side by side and the electrical connections are formed on a three-dimensional basis as distinct from the two-dimensional printed circuit board. The wires are joined by electrical resistance spot welding, which is similar to the vacuum tube technique. After assembly and electrical checking, the unit is "encapsulated" in epoxy potting compounds to form a module. The application of the technique to analogue and digital circuits is described and thermal problems involved are discussed. As a comparison with printed-board technique, a 3-D digital-computer electronic package now being designed will have a total volume of 0.1 cu ft and will weigh under 10 lb, whereas the volume of a tightly designed printed circuit computer package assembled for the same system is 0.4 cu ft with a weight of approximately 26 lb. H.A.Miller

621.389

917 DESIGN BY ALGORITHM: A MATHEMATICAL METHOD OF DESIGNING STANDARD ASSEMBLIES FOR MINIMUM MANUFACTURING COST. D.H.Evans.
I.R.E. Trans Prodn Tech., No. PGPT-4, 4-10 (June, 1959).

621.389

918 MODULAR DIMENSIONING OF ELECTRONIC COMPONENT PARTS FOR MECHANIZED ASSEMBLY. R.A.Gerhold and W.V.Lane.
I.R.E. Trans Prodn Tech., No. PGPT-5, 12-16 (Aug., 1959).

621.389

919 MICRO-MODULES: COMPONENT PARTS AND MATERIALS REQUIREMENTS. S.F.Danko and V.J.Kublin.
I.R.E. Trans Prodn Tech., No. PGPT-5, 29-38 (Aug., 1959).

621.389

920 EVOLUTION OF A SYSTEM FOR THE PRODUCTION OF ELECTRONICS EQUIPMENT—MECHANIZATION OF ALL LOT SIZES. C.P.Cardani.
I.R.E. Trans Prodn Tech., No. PGPT-5, 42-49 (Aug., 1959).

621.389 : 534.1

921 SPACE REQUIREMENTS FOR SIMPLE MECHANICAL SYSTEMS EXCITED BY RANDOM VIBRATION. H.Himelblau and L.M.Keer.
J. Acoust. Soc. Amer., Vol. 32, No. 1, 76-80 (Jan., 1960).

The problem of collision between a simple mechanical oscillator (with damping) and an adjacent rigid member, or between two adjacent simple oscillators, when both are subjected to random vibration is solved in terms of probability of occurrence and the mean time between occurrences. A complete solution is obtained for white Gaussian excitation. This solution can be applied to such problems as the mechanical design of electronic components, bottoming of resilient mounts, and collision between an equipment item and adjacent structure, when the representations of a single degree-of-freedom system can be used.

621.389 : 621.317.32

NEW TECHNIQUES IN PHYSIOLOGICAL RECORDING UNDER DYNAMIC CONDITIONS. See Abstr. 719

621.389 : 621.396.969

922 INVESTIGATION OF THERMAL BALANCE IN MAMMALS BY MEANS OF MICROWAVE RADIATION. B.S.Jacobson, S.B.Prausnitz and C.Slisskind.
I.R.E. Trans Med. Electronics, Vol. ME-6, No. 2, 66-8 (June, 1959).

Whole-body irradiation of mice by electromagnetic energy at a wavelength of 3 cm, carried out in the course of investigations of the microwave radiation hazard, has demonstrated the usefulness of such radiation as a method of studying thermal balance in mammals. An analysis is presented that accounts for observed temperature changes during and after irradiation on the basis of theoretical considerations of thermal disequilibrium.

TELECOMMUNICATION

621.39

923 ERROR-CORRECTING CODES — A LINEAR PROGRAMMING APPROACH. E.J.McCluskey, Jr.
Bell Syst. tech. J., Vol. 38, No. 6, 1485-512 (Nov., 1959).

Two theorems are proved that characterise the matrices used to construct systematic error-correcting codes. A lower bound on the number of required check bits is derived, and it is shown that, in certain cases, this bound for systematic codes is identical with Plotkin's bound on the size of any error-correcting code. A linear programme whose solutions correspond directly to a minimum-redundancy error-correcting code is derived. This linear programme can be solved by an algorithm that is essentially the simplex method modified to produce integer solutions. Explicit solutions in closed form that specify the codes directly are derived for the cases when the specified code parameters satisfy certain restrictions. Several theorems are proved about minimum redundancy codes with related parameters.

621.39

924 THE ACTION OF NON-STATIONARY FLUCTUATIONS ON LINEAR SYSTEMS. Yu.I.Samoilenko.
Radiotekhnika, Vol. 14, No. 7, 17-18 (July, 1959). In Russian.

The problem is solved of finding directly the basic distribution function parameters of fluctuations in linear systems with one degree of freedom when excited by non-stationary stochastic forces. Formulae are found for the dispersion and correlation functions. A recurrence relation is derived from which integrals may be evaluated giving the distribution moments of higher orders.

S.C.Dunn

621.391

925 A NOTE ON THE ESTIMATION OF SIGNAL WAVEFORM. D.Middleton.
I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 86-9 (June, 1959).

The problem of estimating signal waveform from received data that is corrupted by noise is briefly considered from the viewpoint of decision theory, in extension of some earlier work (Abstr. 324 of 1956). The noise is assumed to be a Gauss process, which may or may not be stationary. Here, however, nothing is known about the signal process except that it may be deterministic, entirely random, or a mixed process. Two new features in the present application are the representation of the signal process as a linear expansion (M.S.) in complete orthonormal sets, and suitable choices of these sets. Examples involving discrete and continuous sampling on a finite interval, with various choices of a priori distributions of signal parameters are described, including calculations of Bayes and Minimax risks.

621.391

926 INTEGRATED DATA SYSTEMS. R.Filipowsky.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 95-101 (June, 1959).

Two theoretical data systems (Shannon's ideal channel with average power limitation and the ideal symmetrical binary channel) are compared with the recent results of h.f.-data transmission tests over a 5000-mile link. The 30-to-40-dB increase in signal power required in the practical case is analysed. Non-Gaussian noise, multipath disturbances (fading), and lack of coding are reasons usually mentioned to explain this poor efficiency of presently available data systems. The present paper points towards one additional reason: low-order signal alphabets. Binary or quaternary sets of transmission signals cannot achieve the ideal channel capacity as long as decision systems have to operate at 8-to-10-dB "energy contrast" (E/N_0) for a sufficiently low error rate. To more nearly approach the ideal capacity, it appears necessary to follow most of ten important principles when designing an "integrated" data system. Operating with higher-order signalling systems and applying error-correcting codes are the two principles which promise the largest increase in transmission efficiency. All the rest of these ten "cardinal principles" are discussed briefly.

TELEGRAPH AND TELEPHONE SYSTEMS

621.394.33

927 TELEGRAPH TRANSMISSION IN THE SHORT-WAVE REGION. H.H.Voss and H.J.Neumann.
Nachrichtentech.Z. (N.T.Z.), Vol.12, No.7, 343-7 (July, 1959). In German.

An introduction points out that in spite of the increasing use of submarine cable systems for telegraph working, long-distance telegraphy in the 3–30 Mc/s region over radio channels still holds its own, being cheaper in first cost and in maintenance. "Safe" transmission, which included freedom from distortion, is an over-riding requirement in telegraph working, and a historical review examines the various systems of coding and transmission which have been developed, culminating in present-day systems of "space-diversity" and "frequency-diversity" transmission. Reference is also made to "protected" transmission for telex operation, using van Duuren technique (7-unit code, constant ratio of 3 spaces to 4 marks). Recently developed systems of this kind are then considered in some detail from an operational point of view, particularly that of frequency allocation and channel division. These include the F1 and F6 systems (Duoplex keying) which are f.m. systems using a number of frequencies, time multiplex systems, and a.c. telegraph systems over telephone channels, the so-called W.T.K. systems — which include some f.m. systems. These latter are the F.M.-W.T.K. 3/680, having a frequency swing of ±170 c/s, a bandwidth of 500 c/s and a baud-speed of 200; the F.M.-W.T.K. 6/340, and the F.M.-W.T.K. 16/170, (±85 c/s, 250 c/s and 100 bd., and ± 42.5 c/s, 125 c/s, and 50 bd. respectively). Pictures of equipment racks are included.

W.J.Mitchell

621.394.44

928 A TRANSISTORISED 20-CHANNEL CARRIER TELEGRAPH TERMINAL. T.M.Grybowski and W.G.Vieth.
Trans Amer. Inst. Elect. Engrs I, Vol.78, 260-5 (1959) = Commun. and Electronics, No.43 (July 1959).

The new Western Union type-60 telegraph channel terminal mounts two 10-channel fully-transistorized f.m. groups per bay of standard 19 in. racking, 9 ft 4 in. (285 cm) high along with associated power supplies, bias and leg controls, and metering and monitoring facilities. Current equipment (type-40) mounts ten channels per bay. Transceivers for the two groups are plug-mounted in pairs on five shelves per group, respectively, above and below a centre array of control, metering and jack panels. Adequate ventilation keeps the temperature rise within any transceiver to 12°C. The terminal is fully compatible with other telegraph equipments currently in use, and operates at 75 bauds. The ten channels of each group are spaced at 150 c/s intervals from 375 to 1725 c/s, and are modulated plus and minus 35 c/s for space and mark respectively. The transmitter, comprising keyer, push-pull grounded-emitter oscillator and buffer amplifier, utilizes n–p–n transistors because of their greater frequency stability with temperature, and provides +7.5 dBm at the output of the sending filter (600 ohms impedance). The receiver-limiter has a pair of grounded-emitter amplifiers followed by a pair of discriminator-driver transistors in a complementary symmetry arrangement to provide uniform loading of the discriminator. The latter is followed by a parallel-push-pull arrangement of four transistors driving the polar relay. Attention has been given to ease of maintenance in the design philosophy under the heads of quality components, use of test points and other failure-indicating devices, and plug-in construction.

W.J.Mitchell

621.395.25

929 A NEW SMALL CROSSBAR TELEPHONE SYSTEM FOR PRIVATE BRANCH EXCHANGES. H.H.Abbott.
Trans Amer. Inst. Elect. Engrs I, Vol. 77, 911-18 (1959) = Commun. and Electronics, No. 40 (Jan., 1959).

A description of a private branch exchange developed for use in moderate size business establishments requiring no more than 60 lines to p.b.x. telephone stations and ten trunks to a telephone central office. New customer service and p.b.x. attendant service features, to improve speed and convenience, are explained in detail. A full illustrated description is given of the switching apparatus, equipment and wiring features, power supply, switching plan, basic circuit operations and service protection features.

J.W.Lee

621.395.31

930 PRACTICAL APPLICATIONS OF THE STATISTICAL DEFINITION OF THE PEAK TRAFFIC HOUR TO THE PLANNING AND OPERATION OF TELEPHONE SYSTEMS.
R.Böttger.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 5, 228-32 (May, 1959). In German.

The results of a large number of measurements, made in Munich and Hamburg exchanges, indicate that a new definition of peak traffic hour [Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 4, 205-9 (April, 1959)] is more suitable than the one previously used. It is based on probability rather than on the results of measurements made on particular days.

V.G.Welsby

621.395.31

931 TRAFFIC LOSS OF A CIRCUIT GROUP CONSISTING OF BOTH-WAY CIRCUITS, WHICH IS ACCESSIBLE FOR THE INTERNAL AND EXTERNAL TRAFFIC OF A SUBSCRIBER GROUP. N.Rönnblom.
Tele (English Edition), 1959, No. 2, 79-92.

English translation of a paper already abstracted in Abstr. 5487 (1959).

621.395.33

932 A NEW MANUAL MOBILE TELEPHONE SYSTEM. A.F.Culbertson.
I.R.E. Nat. Convention Record, Vol. 7, Pt 8, 49-58 (1959).

A manual system indicates that an operator must be present to complete the call. This system is designed to fit into the nation-wide telephone service operated by the Bell system and many independent companies. Operating requirements are that there must be compatibility of selective signalling and a uniform method of transmitting supervisory signals. Telephone-grade transmission with speed and simplicity of service are required since a subscriber is unwilling to make any concession to the fact that radio is the medium. Mobile telephony is still a party-line service but fully selective signalling is used. This follows a 600/1500 c/s sequential frequency shift scheme which though rather slow is extremely reliable. It is accomplished with a transistor-type bi-stable switch. To register "6" therefore requires three transistors from 600 to 1500 c/s and three from 1500 to 600 c/s occurring alternately. Another problem is the big changes in transmission level occurring at various points in the chain. In designing the equipment emphasis was placed on reliability, standardization and economy in cost. The problems encountered and their solutions are described and illustrated with schematics and photos,also a diagram showing the transmission level changes at various points in the chain.

B.B.Austin

621.395.34

933 CALCULATION OF DISPERSION IN TELEPHONE TRAFFIC RECORDING VALUES FOR PURE CHANCE TRAFFIC. K.M.Olsson.
Tele (English Edition), 1959, No. 2, 71-8.

English translation of a paper already abstracted in Abstr. 3193 (1958).

621.395.374

934 TELEPHONE CIRCUIT TRAFFIC LOADS. DANISH POST OFFICE LONG-DISTANCE SERVICE AND LOCAL AREA SERVICE IN SOUTH JUTLAND. M.T.Hansen.
Teleteknik (Danish Edition), Vol. 10, No. 2, 71-8 (Sept., 1959). In Danish.

A survey of trunk dialling development. With the installation in June, 1958 of the interurban automatic exchange in Copenhagen, it became possible for subscribers to obtain automatic connection throughout the country. Further extensions have made automatic trunk dialling available to 41.6% of Danish subscribers. A statistical survey is given of the number and traffic load of P.O. long-distance circuits in 1958, with corresponding data for the local area of S.Jutland.

G.N.J.Beck

621.395.44

935 THE GENERATION OF SINGLE SIDEBAND CARRIER TELEPHONE CHANNELS BY POLYPHASE MODULATION. J.R.Mensch.
I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 305-13 (1958).

The modulation technique termed polyphase modulation has been described in the literature. The method is here shown to be suitable for producing s.s.b. telephony channels. The quality of such channels can easily be made to approach that of conventional systems both in bandpass and envelope-distortion characteristics and theoretically can be considerably the better. Although there can be no direct comparison of noise performance, there is a good possibility that satisfactory talking quality can be achieved, so that polyphase modulation may have commercial application for the generation of s.s.b. signals.

A.Wilkinson

621.395.44 : 621.375.4

936 DESIGN CONSIDERATIONS FOR MULTI-CHANNEL TELEPHONE LINE SYSTEMS USING TRANSISTORS.

D.J R.Chapman and A.W.H.Vincent.

Proc. Instn Elect. Engrs, Paper 3042 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 16, 596-600).

The repeater spacing which produces the minimum noise per channel for a given route length, cable type and repeater-amplifier output power is first considered. The optimum spacing is shown to be equivalent to a repeater section of 1-neper loss if the repeater amplifier has a flat gain characteristic. The case where the amplifier gain follows the cable-loss characteristic is also discussed. The relationship between the technical optimum and the best economic spacing is considered: the transistor repeater is shown to permit a closer approach to the technical optimum spacing than is economically possible with a valve repeater. This is because of the lower initial cost of the repeater and its housing and of its lower power consumption. The lower section loss also permits relaxation of the near-end crosstalk requirements for the cable, permitting economies in its construction. The design of transistor repeater amplifiers is discussed, comparing common-base stages in tandem without overall feedback with connections which give considerable current gain but which require overall feedback to obtain the linearity and gain stability required in a repeater. The straightforward common-base connection appears to yield better linearity and stability than the more sophisticated arrangements which give equal gain in a broadband repeater. If the difficulties in the feedback amplifiers can be overcome, it should be possible to design the amplifier gain to follow the cable loss with consequent improvement in noise performance, whereas it is difficult to produce a common-base amplifier with anything substantially different from a flat gain/frequency characteristic.

621.395.44 : 621.375.4

TRANSISTOR FEEDBACK AMPLIFIERS IN CARRIER TELEPHONY SYSTEMS. See Abstr. 856

621.395.44

937 NON-LINEAR DISTORTION IN MULTI-CHANNEL COMMUNICATION SYSTEMS AND ITS DETERMINATION BY SAMPLING MEASUREMENTS. G.Fontanellaz.

Tech. Mitt. P.T.T., Vol. 37, No. 7, 253-62 (1959). In German.

The theory developed by Brockband and Wass (Abstr. 1467 of 1945) is applied to the design of a wide-band multi-channel system. It is shown that useful conclusions about the performance of the system can be obtained from the results of noise measurements made with only a limited number of channels loaded with signals.

V.G.Welsby

TELEPHONE EQUIPMENT
COMMUNICATION NETWORKS AND CABLES

621.395.647 : 621.382.2/.3

938 TRANSISTOR V.F. SIGNAL RECEIVERS. T.H.Flowers.

Proc. Instn Elect. Engrs, Paper 3100 E [International Convention on Transistors and Associated Semiconductor Devices] publ. 1960 (Part B Suppl. No. 16, 625-32).

The sending and receiving of voice-frequency signals over telephone circuits is well established as a practice with thermionic-valve receivers. Transistor receivers would reduce the steady drain on the exchange power supply. Capital cost and reliability in service have yet to be determined. The paper outlines the technical requirements of v.f. receivers, compares the design features of valves and transistors, and uses an experimental design of transistor receiver to illustrate the problems involved.

621.395.664

939 COMMUNICATION EFFICIENCY OF VOCODERS. A.R.Billings.

Electronic Radio Engr, Vol. 36, No. 12, 449-53 (Dec., 1959).

To compare communication and bandwidth compression systems, a term communication efficiency is introduced which is defined as the ratio of the actual rate of transmission of information to the rate at which it would be transmitted by an ideal system subjected to the same restrictions. Using this basis of comparison, a new type of vocoder using pre-modulation before analysis, is compared with the conventional vocoder. This new vocoder, termed the low-power vocoder, is shown to have a higher communication efficiency than the conventional vocoder. Finally, further modifications are suggested which should still further increase the communication efficiency of vocoder systems.

621.395.72

940 TELEPHONE EQUIPMENT FOR THE TROPICS. J.Zalabák.

Slaboproudy Obzor, Vol. 20, No. 8, 476-81 (1959). In Czech.

It is pointed out that total tropicalization is in general not economically justifiable, since only comparatively few devices (e.g. military equipment) have to withstand the full impact of tropical weather. The protection of telephone equipment against the tropics can be achieved either "directly" or by technological and constructional means. Direct protection relies on: (1) adequate protective measures during transport, storage and assembly of equipment; (2) air-conditioning (control of temperature and humidity) of buildings where the equipment is used; and (3) microclimatization or air-conditioning of the most sensitive areas of the equipment (e.g. telephone exchanges). Technological protection must be based on the principle that the equipment is either hermetically sealed or perfectly ventilated. Protection is secured by employing suitable conducting and insulating materials, impregnation, varnish coatings and potting. The equipment should be additionally protected against attack from tropical micro-organisms and insects.

R.S.Sidorowicz

621.395.74

941 AUTOMATIZATION OF THE STATE RAILWAY TELEPHONE SYSTEM [IN FINLAND]. K Toivola.

Kraft o. Ljus, Vol. 32, No. 10, 226-30 (Oct., 1959). In Swedish.

The railway telephone system is completely separate from the public network. The exchanges are zone distribution, junction and terminal exchanges. These are shown in a diagram covering the whole country. Attenuation problems and traffic measurements are discussed. Operation of the dialling system is explained, the weakest point being the overloaded exchange in Helsinki, which will be improved.

G.N.J.Beck

621.395.74 : 621.316.98

942 THE PROTECTION OF COMMUNICATION CABLES AGAINST DIRECT LIGHTNING STROKES. M.Zapletal.

Elektrotech Obzor, Vol.48, No.8, 401-6 (1959). In Czech.

Discusses the probability of lightning strokes to communication cables and derives a relation for the expected number of strokes as a function of lightning frequency, breakdown strength and resistivity of soil and the distribution function of the current peak of the strokes. Relations are given for the highest potential difference between cable sheath and cores and single-and multiple-insulation breakdowns are discussed. Describes, and treats comparatively, various methods of cable protection against strokes; prefers a copper conductor above the cable to special protective armouring, or to increased insulation thickness.

N.Klein

621.395.74

943 THE PHOTOGRAMMETRIC PRODUCTION OF ROUTE PLANS FOR TELEPHONE CABLE INSTALLATIONS. M.Zurbuchen and J.Ott.

Tech. Mitt. P.T.T., Vol. 37, No. 7, 268-74 (1959). In German and French.

Describes the use of aerial photography to prepare route plans in cases where the terrain would make ordinary surveying methods difficult and expensive.

V.G.Welsby

621.395.74

944 PROBLEMS OF CORROSION IN LEAD-COVERED CABLES. (10th REPORT). K.Vögtli.

Tech. Mitt. P.T.T., Vol.37, No.10, 430-44 (1959) In German and French.

For 9th report see Abstr. 3062 (1959). Results are given of tests on sample lengths of various types of cables, buried in regions where there is danger of lead corrosion. (This is one of a series of reports).

V.G.Welsby

621.395.741

945 GLOBAL PUBLIC TELEPHONE SERVICE — 1958. D.D.Donald and T.A.Chandler.

I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 115-20 (June, 1959).

A review of some aspects of public telephone service in the light of the important developments that have taken place since 1954.

621.395.812.5

946 THE INFLUENCES OF EARTH MAGNETIC CURRENTS ON TELECOMMUNICATION LINES.

THE ORIGIN AND CHARACTER OF EARTH MAGNETIC CURRENTS AND THEIR INFLUENCES ON RAILWAY AND TELECOMMUNICATION CONDUCTORS. Å.Karsberg.

DISTURBANCES CAUSED BY EARTH CURRENTS TO TELECOMMUNICATION PLANTS. G.Swedenborg and K.Wyke.

Tele (English Edition), 1959, No. 1, 28-41, 41-8.

English translation of papers already abstracted in Abstr. 5507-8 (1959).

ELECTROACOUSTIC APPARATUS

621.395.61 : 612.7

947 TOWARD A MODEL FOR SPEECH RECOGNITION. K.N.Stevens.

J. Acoust. Soc. Amer., Vol. 32, No. 1, 47-55 (Jan., 1960).

An approach to the design of a machine for the recognition and synthesis of speech is proposed, with particular emphasis on problems of acoustical analysis. As a recognizer, the proposed machine accepts a speech wave at its input and generates a sequence of phonetic symbols at its output; as a synthesizer it accepts a sequence of symbols at its input and generates a speech wave. Coupling between the acoustical speech signal and the machine is achieved through two peripheral units: one an analog filter set or equivalent, and the other a model of the vocal tract. Between the analog filters and the phonetic output the signal undergoes an intermediate form of representation that is related to vocal-tract configurations and excitations but is not necessarily described specifically in these terms. Each stage of analysis is performed by synthesis of a number of alternative signals or patterns according to rules stored within the machine and by comparison of the synthesized patterns with the input signals that are under analysis. Possible advantages of the proposed method of analysis are discussed. An experimental study based on the general analysis approach is described. In this study a method for the determination of the frequencies of vocal-tract resonances from the speech wave is simulated on a digital computer.

621.395.61 : 621.372.412 : 537.2 : 539.2

948 DETERMINATION OF PIEZOELECTRIC PROPERTIES AS A FUNCTION OF PRESSURE AND TEMPERATURE.

J.E.McKinney and C.S.Bowyer.

J. Acoust. Soc. Amer., 56-61 (Jan., 1960).

Piezoelectric data on a mixed titanate system (82.0% $BaTiO_3$, 3.6% $PbTiO_3$, and 4.4% TiO_2) were obtained with an apparatus intended to measure the dynamic compressibility of materials. The calibration constant, determined from measurements on specimens of known compressibility, involves the piezoelectric and dielectric constants of the ceramics used as transducers. The method is discussed and an operating equation for the apparatus derived. Piezoelectric and dielectric constants have been measured as a function of temperature and pressure over the ranges: – 25 to 37.5°C and 0 to 1000 kg/cm². An apparent phase transition was observed near 5°C. A qualitative discussion of the results is given.

621.395.61

949 PHYSICAL EFFECTS OF INTENSE ACOUSTIC FIELDS OF ULTRASONIC FREQUENCIES IN LIQUIDS.

O.Taraba.

Elektrotech. Obzor, Vol. 48, No. 7, 373-8 (1959). In Czech.

After a survey of the uses of ultrasonic techniques, magnetostriction generators and the design principles of magnetostrictive converters are discussed. A magnetostriction generator was used for the emulsification of certain oils. The efficiency of this arrangement was low, and similarly unsatisfactory was a piezoelectric generator. Much better results were obtained with an ejector-type generator, which is described with the help of cross-section diagrams and a photograph. N.Klein

621.395.62

950 STEREOPHONIC TV SOUND.

Electronics, Vol. 32, No. 44, 64 (Oct. 30, 1959).

The difference signal (A-B) of the two channels passes through filters which limit the band to 500 c/s-7.5 kc/s. The signal is then applied to a balanced modulator fed from a 15.75 kc/s oscillator which is locked to the line synch. signals. The output from the modulator passes through a lower-sideband filter which suppresses the 15.75 kc/s carrier and the upper sideband. The output from the filter is combined with the sum signal (A + B) for application to the conventional f.m. sound modulator. At the receiver the sum and difference signals are separated by appropriate filters after the 15.75 kc/s sub-carrier has been re-established by an oscillator driven from the local synch signals. H.G.M.Spratt

621.395.62

951 SOUND LOCATION IN LIVE AND STEREOPHONIC SYSTEMS. F.H.Brittain.

Proc. Instn Elect. Engrs [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] Part B Suppl. No. 14, 209-10 (1959).

Recent research on hearing is summarized. A sound source is located primarily as a result of inter-aural time differences, small head movements removing ambiguities. Aural fusion occurs for 2-channel systems for time differences up to ½ milli-second, partial combination occurring up to 5 milli-seconds. Early workers thought that the relative intensity of sound at the two ears was used in location. This is disproved by the fact that extreme low frequencies, giving a small fraction of a decibel interaural intensity differences, are readily located. It appears that the nerve responses associated with the hearing mechanism can transmit a detailed waveform up to about 1 kc/s. Above this frequency, an approximation to the wave envelope may be sent. Also it has been shown that true sine-wave test conditions require harmonics to be 60 dB down. An effective interaural arrival-time difference is produced in 2-channel reproduction when the sound intensity from one loudspeaker is increased, the apparent angular displacement varying with frequency in the form of a step function at 1-2 kc/s, where the mode of hearing changes. This effect is not adequately compensated in many recordings, resulting in misplacement of high frequency components. The problems of microphone pick-up for good 2-channel stereophonic effects are discussed, the basic requirement being the necessity of producing the appropriate changes in output so as to move the sound image in step with the original source. The spaced microphone technique helps to preserve the virtual stage width but may lead to "a hole in the middle". The effects of off-centre listening are discussed, and also the preferred loudspeaker directional characteristics It is said that even a fairly poor stereophonic system can give a great increase in realism even if precise source location is not achieved, the monophonic "hole in the wall" effect being removed. M.L.Gayford

621.395.623

952 STEREOPHONIC SOUND IN THE CINEMA. J.Moir.

Proc. Instn Elect. Engrs [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] Part B Suppl. No. 14, 221-3 (1959).

Stereophonic sound was introduced to the cinema in the U.S.A. during 1939. 3 photographic sound tracks recorded on a separate synchronized 35 mm film were used. In 1952, 3 magnetically-recorded channels on the edge of the picture film were used. In order to obtain good stereophonic effects over an economic number of seats, up to 5 channels magnetically recorded on the edges of 70 mm films have since been used. Projection equipment and studio techniques are briefly described. Pseudo-stereophonic effects such as the widely-used "pan-pot" techniques are mentioned. The limitations of pseudo-stereophony and the inherent difficulties of maintaining good sound and vision perspective with any system are touched on. M.L.Gayford

621.395.625

953 INVESTIGATIONS OF THE INFLUENCE OF THE ACOUSTICAL PROPERTIES OF ROOMS ON STEREOPHONIC SOUND REPRODUCTION. J.J.Figwer.

Proc. Instn Elect. Engrs [Convention on Stereophonic Sound Recording. Reproduction and Broadcasting] Part B Suppl. No. 14, 211-13 (1959).

The first problem in the investigation of the acoustical

influence of the listening enclosure on stereophonic sound reproduction is to determine the principal factors operating. It is contended that the most rewarding starting point is the study of stereophonic sound localization and subjective quality in regard to the influence of a single sound reflection and of a number of sound reflections of various amplitudes and delays, two channel systems being mainly considered. Sound source localization and speech quality tests were carried out in cinemas, the general conclusions being that stereophonic reproduction quality, rather than source localization, is more likely to be upset by sound reflections, and that it is desirable to reduce the reverberation time of existing auditoria by 10-15%. It is not clear how many experimental results were used as a basis for this conclusion. M.L.Gayford

621.395.625

954 STEREOPHONIC RECORDING ON MAGNETIC TAPE. G.F.Dutton.

Proc. Instn Elect. Engrs [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] Part B Suppl. No. 14, 216-18 (1959).

Stereophonic 7½ in/sec tape records were introduced both here and in the U.S.A. in 1956, but, in spite of the generally better and more uniform performance, they have not achieved anything like the popularity of the current stereophonic gramophone records. Apart from the nuisance of tape threading and the difficulty of locating portions of a musical selection, high cost has proved a major obstacle. This is partly due to the cost of tape material and partly due to the difficulty of providing a cheap flutter- and hum-free tape reproducing machine. It would appear that a limited price reduction is possible by a more economic use of the tape as regards recording density i.e. reducing tape speed and increasing the number of tracks. The high frequency replay losses due to spacing loss (i.e. imperfect tape contact with the head), thickness loss and loss due to replay head gap are considered. It is pointed out that the high frequency performance of tapes with different surface roughness can vary over 20 dB due to spacing loss. Noise level is increased in tapes produced by dubbing and there is a case for reviewing the standard amount of pre-emphasis in the light of modern tape performance. Sources of tape noise are discussed in detail. M.L.Gayford

621.395.625

955 THE 45/45 STEREOPHONIC DISC STANDARDS. COMMENTS ON THE PRACTICAL OPERATION OF THE SYSTEM. G.F.Dutton.

Proc. Instn Elect. Engrs [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] Part B Suppl. No. 14, 251-3 (1959).

The standards were drawn up in 1957 and have been generally agreed on in Europe and the U.S.A. Minor points of difference between various recording organizations and possible tolerance changes are discussed. Some points have not been standardized, e.g. due to the moving system pivotal point being above the disk surface, the cutter movement in many U.S. recordings is 23° from the normal, giving rise to some tracing distortion with normal pick-ups. A compromise angle of 12° is suggested. It is pointed out that processing of the lacquer master-disks may cause ±5° variations in groove angle and up to 0.0002 in. on bottom radius. Many other useful points are discussed, such as stereophonic balance and cross-talk, light pattern tests, aural balance procedure, record wear and the properties of various types of stereophonic pick-ups. A plea is made for standardization of non-reversible plugs and sockets so as to preserve correct phasing throughout stereophonic systems. M.L.Gayford

621.395.625

956 A SURVEY OF STEREOPHONY AS APPLIED TO BROADCASTING. D.E.L.Shorter.

Proc. Instn Elect. Engrs, Paper 3177E [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] publ. 1959 (Part B Suppl. No. 14, 226-33).

The introduction of stereophonic records has demonstrated the improvement in realism obtainable under domestic conditions even with fairly modest reproducing equipment. Broadcasters must therefore study stereophonic problems. In live programmes, much more rehearsal and control of the position of artistes is needed and the performance of programme distributing lines may be inadequate. The problems of compatibility are discussed, it being difficult to obtain monophonic results of consistently high quality from studio arrangements primarily set up to give optimum stereophonic results. Most proposed broadcasting systems employ some form of multiplex transmission. These are discussed in detail, including their bearing on compatibility and domestic receiver design. The generation of loudspeaker polarity test signals and the impact of stereophony on television are also discussed. M.L.Gayford

621.395.625

957 THE SOUND OF RAIN. M.R.Schroeder and B.F.Logan.

Frequenz, Vol. 13, No. 6, 229-34 (Aug., 1959).

Discusses the statistics of the sound of rain falling on a uniform plane surface. The generation of this sound, which might be called "rain noise", by electronic means is described. Experimental results indicate that the rain noise obtained by circuitry proposed here sounds much more realistic than the Gaussian noise which is usually employed to simulate the sound of rain. Applications of generators for realistic rain noise can be found in radio, television, the theatre and, possibly, psycho-therapy. The advantage of using electronic generators compared to a "library" of tape recordings is the high degree of adaptability of the former to wide variety of practical rain situations.

621.395.625.2 : 537.7

958 THERMOPLASTIC RECORDING. W.E.Glenn.

J. appl. Phys., Vol. 30, No. 12, 1870-5 (Dec., 1959).

A new method is described for recording electrical signals. Information is written at extremely high density by means of an electron beam on a film consisting of a low melting thermoplastic material. This can be projected as a full colour image, or can be converted to an electrical signal. The tape, which is processed by quick heating, can be readily erased and re-used.

621.395.625.3 : 534.86

959 EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE MAGNETIC PROPERTIES OF IRON OXIDE RECORDING TAPE. E.D.Daniel and I.Levine.

J. Acoust. Soc. Amer., Vol. 32, No. 1, 1-15 (Jan., 1960).

The results of remanent magnetization tests made under ordinary and anhysteretic conditions are given, and it is shown that the major anhysteretic properties of a recording tape can be expressed in terms of three easily measured constants. The design of the test equipment is discussed and test results are listed for thirteen representative types of tape. Some of the theories of fine particle magnets that can be applied to recording tape are reviewed and an extensive treatment of remanent magnetization based upon the Preisach diagram is given. Some aspects of the Preisach diagram treatment may be of interest to workers outside the magnetic recording field. The anhysteretic properties are important in h.f. biased recording

621.395.625.3

960 THE RECORDING AND REPRODUCTION OF SIGNALS ON MAGNETIC MEDIUM USING SATURATION-TYPE RECORDING. J.J.Miyata and R.R.Hartel.

I.R.E. Trans Electronic Comput., Vol.EC.8, No.2, 159-69 (June, 1959).

Discussed various factors affecting resolution in saturation magnetic recording. The effect on the recording process of the B–H characteristics of the coating, coating thickness, record-head gap width, head-to-coating separation, self-demagnetization, and record-head residual magnetization are discussed. Equations are derived for the playback process relating the signal amplitude and pulse width to the coating thickness, head-coating separation, and effective gap width of the playback head. It is shown that the greatest improvement in resolution can be obtained by the development of an extremely thin coating with high ratio of coercitivity to remanence and having a rectangular B–H loop. The extremely thin coating will reduce the shortcomings of the record-head field pattern, the self-demagnetization effect, and the loss of resolution in the playback process.

621.395.625.3

961 A NEW MAGNETIC RECORDING SYSTEM. A.D.Burt and D.R.Andrews.

Proc. Instn Elect. Engrs [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] Part B Suppl. No. 14, 219-20 (1959).

In order to overcome threading difficulties and uneconomic utilization of the tape for home entertainment, a new tape cartridge has been developed. When used in conjunction with new narrow gap (90×10^{-6} in) heads, a satisfactory response is achieved (to over 10 kc/s) at a tape speed of 3¾ in/sec. 4 tracks 0.043 in. wide with

0.025 in. separation are accommodated on standard ¼ in. tape, 600 ft of tape giving 2 hours playing time for 3 in. spacing of hub centres. Magazine loading transport mechanisms have been designed for machines using the cartridge. A fully automatic mechanism is available so that no manual manipulation is required, the tape reversing automatically at the end of each track, two capstans and dual heads being used. Stereophonic recording can be used for 1 hr playing time. The first amplifying stage is a low-noise transistor. A detailed description with an exploded view of the cartridge is given.

M.L.Gayford

621.395.625.77 : 534.64

962 SOUND TRANSMISSIVITY OF FABRIC SCREENS, WOOD MESH SCREENS AND CINEMA SCREENS. J.Steinert.

Hochfrequenztech. u. ElektAkust., Vol. 67, No. 6, 169-74 (March, 1959). In German.

Reference is made to screens used for radio receivers, the materials of which besides their aesthetic function must not damp the sound appreciably nor perceptibly modify the sound picture. In modern cinemas the screen must not only reflect the light but must also transmit, with a minimum of attenuation, the sound from the loudspeaker groups behind the screen. Measurements have been made of the sound transmission coefficients of various types of screen in the frequency range 10^3 to 10^4 c/s. The materials used varied from fabrics to wood mesh and solid walls with perforations.

A.B.Wood

RADIOCOMMUNICATION

621.396

963 COMMUNICATIONS DISPLAY AND CONTROL — A NEW CONCEPT. R.J.Meyer.

I.R.E. Nat. Convention Record, Vol. 7, Pt 9, 73-9 (1959).

A programme carried out to develop an improved man–machine control and display system for u.h.f. communications function is described. The results of a series of controlled tests conducted to determine the design features of the system are given. The system developed gives an approach to the problem of providing a control and display relationship that is integrated from the human point of view.

J.W.Lee

621.396

964 APPLICATION OF THE STATIONARY PHASE PRINCIPLE TO THE CALCULATION OF RADIO PULSE SPECTRA. D.E.Vakman.

Radiotekhnika i Elektronika, Vol. 4, No. 7, 1124-33 (July, 1959). In Russian.

Analyses a high-frequency voltage pulse of the form

$$u(t) = Af(x)\, e^{-j[w_0 \tau x + k\phi(x)]}$$

where A, w_0, τ are the amplitude, carrier frequency and some conditional pulse length; $x = t/\tau$ is dimensionless time; $f(x) \leq 1$ is a symmetrical (even) bell-shaped envelope; $k = 2\pi\epsilon A\tau$ is the index of phase modulation ($k \gg 1$); ϵ is the electronic frequency displacement in c/v; $\phi(x) = \int_0^x f(x)dx$ is the law of phase variation. After finding the form of the spectrum by the usual stationary phase method a modification of the method is proposed, and its connection with the "instantaneous frequency" method is discussed. The results are applied to a probability pulse with k = 0 to 80.

D.E.Brown

621.396.2 : 621.396.65

965 MICROWAVE AND SCATTER COMMUNICATIONS SYSTEM FOR THE EGLIN GULF TESTING RANGE. T.J.Heckelman.

I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 136-41 (June, 1959).

A seven-hop 295-mile combined microwave and tropospheric forward-scatter communications system is being installed for carrying voice, timing, telemetering, radar data, and controls. System design of the frequency-diversity 7 kMc/s system is reviewed, as well as the design of the four-fold diversity 2 kMc/s scatter system. Problems of special interest on transmission of timing signals, telemetry, and radar digital data are discussed and solutions indicated. Considerations for reliability, flexibility and ease of maintenance are indicated. Integration of the range operations by use of the communications system is described.

621.396.2 : 621.396.65

966 A LOOP MICROWAVE SYSTEM DESIGN. R.H.Davis.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 498-504 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

A brief description is given of a microwave communications system connecting off-shore oil platforms, in the Gulf of Mexico, to each other and to land stations. The system has a loop configuration giving any station located on the loop access to any other station via two separate directions of transmission, clockwise and counter-clockwise. In order to prevent "singing", the loop is broken at a master station which has facilities for detecting interruptions in the loop circuit. In the event of a break the master station automatically closes the loop and restores service. Reliability comparisons are drawn between loop, diversity and non-diversity systems.

H.L.Nattrass

621.396.215

967 FREQUENCY SHIFTS IMPROVE PULSE COMMUNICATIONS. J.L.Hollis.

Electronics, Vol. 32, No. 25, 66-9 (June 19, 1959).

Multiple-path reception of long-range pulse transmissions often produce serious time distortions in the signal. In order to reduce multiple-path interference the equipment described simultaneously shifts the transmitter and receiver frequencies to provide reception sensitive only to transmission arriving by the shortest path. The circuits discussed separate the mark and space signals by 6 kc/s and, following keying, step them both by 0.8 kc/s increments through a seven-stage cycle. By the time the cycle is repeated the multiple-path transmissions at the first frequency will have died out. The operation of the equipment is described in fair detail.

H.L.Nattrass

621.396.216

968 AN EXPANDED THEORY FOR SIGNAL-TO-NOISE PERFORMANCE OF F.M. SYSTEMS CARRYING FREQUENCY DIVISION MULTIPLEX. D.P.Harris.

I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 298-304 (1958).

From analysis by Ming Chen Wang of the minimum detectable modulation for a single-channel f.m. system, a method of determining the theoretical s./n. characteristics for any multiplex channel under any input conditions is developed. The case of heavy amplitude-limiting in the presence of fluctuation noise for a rectangular bandpass is considered. The theoretical results are compared with experimental curves to indicate how closely they may be expected to agree for typical receivers. The results are directly applicable to s.s.b.s.c. multiplex systems which have no thresholds associated with multiplex channel receivers. If a.m. or f.m. subcarrier multiplex is used, the s./n. values determined by the method described must be suitably adjusted for subcarrier deviations and receiver bandwidths, the resulting s./n. ratios then being considered as the input c./n. ratios for the subcarrier receivers, c./n. being the ratio of the received carrier power to the total noise power in the receiver bandwidth.

A.Wilkinson

621.396.34

969 ELECTRONIC MULTIPLEX RADIO-TELEPRINTER EQUIPMENT WITH AUTOMATIC CORRECTION. E.V.Lous.

Teleteknik (Danish Edition), Vol. 10, No. 2, 47-61 (Sept., 1959). In Danish.

The equipment described provides facilities for private permanent circuits between Denmark and the United States. It operates exclusively with electronic circuits, the principles of which are explained. There is a special subdivision of individual channels which enables one channel to be utilized by several subscribers, so that the cost of maintaining a permanent station-to-station circuit becomes correspondingly lower per subscriber. Synchronization and control, phasing between transmitter and receiver, measurement equipment, channel division and the radio link proper (a twin-plex system), are all dealt with.

G.N.J.Beck

621.396.41

970 AN EXPERIMENTAL AUTOMATIC COMMUNICATION SYSTEM FOR AIR TRAFFIC CONTROL. W.R.Deal.

I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 71-6 (June, 1959).

This experimental system (A.G.A.C.S.) will provide a two-way traffic control data link permitting automatic mechanized communication for essential routine flight information between the air and

ground environments. The system selected is operable in both v.h.f. and u.h.f. aircraft communication bands and permits choice of f.s.k.-carrier or f.s.k.-a.m. modulation. Up to 500 aircraft may be interrogated and reply on a single channel in a time period of two minutes or less. Information is binary coded and transmitted by time-division multiplex techniques at a data rate of 750 bits/sec.

621.396.41

971 SYNCHRONIZATION OF SINGLE-SIDEBAND CARRIER SYSTEMS FOR HIGH-SPEED DATA TRANSMISSION. T.Combellick.
I.R.E.Trans Commun. Syst., Vol.CS-7, No.2, 110-14 (June, 1959).

Requirements for synchronization of single-sideband carrier systems and the methods of accomplishing absolute synchronization are stated. The problems of application to existing systems and alternative solutions are discussed.

621.396.43 : 621.376.3

972 FACTORS AFFECTING MODULATION TECHNIQUES FOR V.H.F. SCATTER SYSTEMS. J.W.Koch.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 77-92 (June, 1959).

An experimental programme at approximately 50 Mc/s has been carried out over a 1295 km east–west ionospheric-scatter path to determine the communication capacity of the propagation medium using ordinary modulation techniques. Binary error-rate studies using dual-narrow-band f.s.k. terminal equipment were made to observe the dependence of error rate in scatter propoagation on signal-to-noise ratio, multipath factors, and Doppler shifts. With respect to multipath limitation, using aerials of 6° beamwidth, error rate is found to be independent of transmission speed to 500 binary digits/sec. Tests were made using dual diversity narrow-beam rhombic aerials, and dual- and quadrupole diversity broad-beam Yagi aerials. The use of four Yagi aerials gave very promising results as compared to use of two narrow-beam aerials. Frequency shifts of 2, 4, and 6 kc/s were used to determine the effect of meteor Doppler components in the received signal, leading to recommendations for minimum frequency shift. Though actual modulation tests have so far been made at a frequency of 49.6 Mc/s only, systematic observations of long-delay signals of the order of 10 to 80 msec were made at 30 and 40 Mc/s, using pulse techniques. These delayed signals arrived at the receiver via the F_2 backscatter mode, and were occasionally of sufficient strength to cause binary errors for circuits operating in these frequency ranges. Studies of intelligibility for voice transmission were made using n.b.f.m. and s.s.b. Using 20 kW power, the f.m. tests with dual-diversity receivers and narrow-beam rhombic aerials gave good results at levels of signal-to-noise ratio exceeded for 90% of the year at 50 Mc/s.

TRANSMITTERS . RECEIVERS

621.396.61/.62

973 DOUBLE-SIDEBAND SUPPRESSED-CARRIER MULTIPLEX EQUIPMENT FOR CABLE AND MICROWAVE APPLICATIONS. W.S.Chaskin and G.L.Curtis.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 92-4 (June, 1959).

621.396.62

974 A SYNCHRONOUS COMMUNICATIONS RECEIVER FOR THE MILITARY U.H.F. BAND.
R.H.Wood and W.P.Whyland.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 129-33 (June, 1959).

A synchronous receiver for d.s.b. suppressed carrier signals in the 225 to 400 Mc/s band is described. The receiver is suitable for voice or data link operation and provides automatic correction of Doppler shifts in the received signal. The "local carrier" oscillator is crystal stabilized at the i.f. frequency, and electronically tuned by a closed servo loop in which the locally generated carrier is compared with the received double-sideband signal. The parameters of the a.f.c. loop have been designed to provide correction from ±5 kc/s. The receiver extends the advantages of suppressed carrier communications to high-performance aircraft in the u.h.f. or higher frequency bands.

621.396.621.5

975 TEMPERATURE INFLUENCE OF THE AERIAL AND MIXER ON THE NOISE FIGURE OF CENTIMETRIC RECEIVER. I.V.Shavlovskii.
Radiotekhnika, Vol. 14, No. 7, 56-62 (July, 1959). In Russian.

Presents design formulae giving the difference between the rated and actual noise figure values of a receiver and for the change in sensitivity of the receiver as a function of effective operating temperature of the aerial and mixer. Experimental results show that cooling the crystal mixer down to −70° C results in a improvement of the noise figure between 12% to 35% depending on the type of the crystal used and the bandwidth of the input circuit. The crystals investigated were IN415D and IN415E. Z.F.Voyner

621.396.621.54 : 621.376.3

976 A NEW HIGH[LY] SENSITIVE RECEIVING SYSTEM FOR FREQUENCY MODULATED WAVE.
M.Morita and S.Ito.
J. Inst. Elect. Commun. Engrs Japan, Vol.42, No.8, 737-44 (Aug., 1959). In Japanese.

In this system, a negative-feedback phase-detector and demodulation system is used in which the phase difference is detected between the received signal and the voltage of the local oscillator, whose frequency is synchronized with that of the received signal. By making the voltage derived from the local oscillator sufficiently large, normal demodulation can be maintained even if the amplitude of the signal becomes < that of the noise, with the result that the threshold level is improved. Negative-feedback f.m. is also used, part of the receiver output being applied to the local oscillator to cause it to be frequency modulated. The phase detector can thus be operated within the narrow range of the linear portion of its characteristic curve, so that an optimum distortion factor can be maintained. Hence, by increasing the degree of modulation of the transmitter, an optimum channel s./n. ratio can be obtained. Experiments show that with such a receiving system in a 60-channel multiplex link, the results are equivalent to those obtained by a 10-fold increase of transmitter power. In comparison with a s.s.b. system, a higher s./n. ratio and an equal sensitivity are obtained with much simpler equipment. One of the essential problems of the new system is the synchronization of the frequency and phase of the local oscillator with those of the received signal, but this is easily achieved by extending the negative-feedback action of the feedback circuit to d.c. A.Wilkinson

AERIALS

621.396.67 : 621.396.8

977 THE PERFORMANCE OF A BALANCED AERIAL WHEN CONNECTED DIRECTLY TO A COAXIAL CABLE.
G.D.Monteath and P.Knight.
Proc. Instn Elect. Engrs, Paper 3079E, publ. Jan., 1960 (Vol.107 B, 21-5).

Measurements have been made of the radiation patterns of typical aerials, such as would be used for domestic reception in the v.h.f. band, connected directly to a coaxial cable without the intervention of a balance/unbalance transformer. The vertical radiation pattern may be appreciably distorted, owing to the excitation of currents on the outside of the cable and the sensitivity to vertically-polarized interference originating near to and below the aerial may be increased. The distortion of the radiation pattern appears to be less serious with directional aerials. The use of a balance/unbalance transformer or a balanced feeder would be desirable, but unless the input circuit of the receiver is either balanced, or screened and unbalanced, no ideal solution exists.

621.396.674

978 OPERATION OF CLOSE-SPACED ANTENNAS IN RADIO RELAY SYSTEMS. W.F.Biggerstaff.
I.R.E. Trans Vehicular Commun., No. PGVC-13, 11-15 (Sept., 1959).

The required attenuation between transmitter output and receiver input for any given pair of equipments may be measured by a method that takes into account both receiver desensitization caused by front end overloading and the interference effects of transmitter noise side bands. These are the two principal causes of degradation in receiver performance where simultaneous transmission and reception is to be accomplished from aerials to be placed in close

proximity. With the required isolation known, curves may be consulted to determine the necessary aerial physical spacing, either colinear or in the same plane. The actual attenuation between two aerials including their associated transmission lines may be measured and, lastly, the presence of any receiver desensitization may be determined under practical operating conditions. A method for increasing the isolation between close-spaced vertical aerials for a given transmitter operating frequency is described.

621.396.677

979 A NETWORK FOR COMBINING RADIO SYSTEMS AT 4, 6 AND 11 kmc. E.T.Harkless.

Bell Syst. tech. J., Vol. 38, No. 5, 1253-67 (Sept., 1959).

Development of the broadband horn reflector aerial has permitted the simultaneous radiation and reception of radio signals on different frequencies in the three common-carrier bands in which radio relay systems are used. A necessary adjunct to the aerial is a network to combine or separate the common carrier bands and also to combine or separate the two polarizations of any one band. The particular form of the network that is described was designed to meet strict system requirements on impedance match, insertion loss and cross-coupling between ports.

621.396.677

980 GLIDE-SLOPE ANTENNA ARRAYS FOR USE UNDER ADVERSE SITING CONDITIONS. F.W.Iden.

I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 100-11 (June, 1959).

The problems of generation of an adequate glide-slope signal on a practical airport site are examined, with particular attention to the path-shape degradation introduced by inadequate smooth surface in the primary reflecting area, and hills and similar mirror obstructions under the approach line. Quality factors are derived to establish comparison standards to evaluate the relative performance to be expected in application of various of the available arrays to any particular site. Two arrays are described, which have been found to provide substantial improvement in certain of these defective sites.

621.396.677

981 INTERFEROMETER PHASING PROBLEMS AT MICROWAVE FREQUENCIES. G.Swarup and K.S.Yang.

I.R.E. WESCON Convention Record, Vol. 3, Pt 1, 17-24 (1959).

The effects of amplitude and phase errors of individual elements on the directivity and side radiation pattern of an interferometer system are discussed. In the case of phase-switched interferometers it is also important to evaluate the effect of fixed phase error of the switch and feeder system, and phase throw error of the switch, on the radiation pattern. It is shown that these phase errors affect the shape of the radiation pattern only if there exists an odd component in the two-dimensional electric field distribution over an aperture. Details of construction of the transmission line system of a cross aerial for operation at 9 cm. wavelength are described. The aerial has 16 paraboloidal reflectors in each arm of the cross and provides a pencil beam of nearly 4 minutes of arc width. The experimental technique employed in adjusting amplitude and phase of the field, impressed on each element of the interferometer, is also described.

621.396.677

982 METHODS FOR OBSERVATION OF SOLAR RADIO EMISSION. F.R.Neubauer.

Tijdschr. Ned. Radiogenoot., Vol. 24, No. 4, 165-71 (1959). In Dutch.

The three principal types of instrument used in solar radio-astronomical observations are reviewed: (1) Interferometers. The position of a source of enhanced radiation can be determined accurately with a two-element interferometer, while a multi-element interferometer enables the complete distribution of intensity over the solar disk to be obtained in one dimension. Crossed arrays enable the two-dimensional distribution to be determined. (2) Polarimeters. The state of polarisation of solar radio emission can be determined by means of four independent measurements. The polarimeter used at the Nera observatory in Holland is described. It works on 200 Mc/s and uses a parabolic reflector with two vertical dipoles at the focus. (3) Spectrometers. A brief account is given of the radio spectrograph for determining the spectral intensity distribution, with oscillograph display and photography on moving film.

G.N.J.Beck

621.396.677.32

983 ON THE PHASE VELOCITY OF WAVE PROPAGATION ALONG AN INFINITE YAGI STRUCTURE.

D.L.Sengupta.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 234-9 (July, 1959).

An approximate expression is derived for the phase velocity of wave propagation along an infinite Yagi structure and its dependence on the various parameters of the structure is discussed in detail. The structure is at first studied qualitatively by applying the transmission line analogy. The problem is next treated from the viewpoints of linear aerial and field theories. It is assumed that a travelling wave is propagating along the axial direction and it induces an axially symmetric and sinusoidal current distribution in each element. The electric field at any point due to this current distribution is calculated by the Hertz vector method. After applying boundary conditions to the electric field, an expression for the propagation constant is derived. The results are compared with existing experimental values. The agreement between theory and experiment is found to be within 5%. The accuracy of the expression given is sufficient for practical purposes.

621.396.677.71

984 RADIATION FROM SLOT ARRAYS ON CONES. R.F.Goodrich, R.E.Kleinman, A.L.Maffett, C.E.Schensted, K.M.Siegel, M.G.Chernin, H.E.Shanks and R.E.Plummer.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 213-22 (July, 1959).

A method is obtained for determining far field patterns, sidelobes as well as the main beam, for an array of slots on the surface of a cone. It is found that accurate results can be obtained for a single slot by using geometric optics for the main beam and an extension of Fock theory for fields in the shadow region. The tip contribution is computed by physical optics and, for reasonably thin cones, is found to be negligible. The array pattern is obtained by appropriately summing the single slot fields. To test the validity of the method and to test the ease with which computations could be performed, a radiation pattern from a linear array of 65 slots on the surface of a cone was computed and compared with experiment. The agreement is excellent. The major theoretical part of this paper is the generalisation and simplification of Fock theory as applied to the surface of a cone.

621.396.677.55 : 538.56

985 CORNER-DRIVEN COUPLED SQUARE LOOP ANTENNAS. S.Prasad.

Canad. J. Phys., Vol. 37, No. 12, 1407-17 (Dec., 1959).

A theory for two identical square loop aerials driven in the zeroth-phase sequence (voltages in phase at all four corners) and the second-phase sequence (voltages in and out of phase at the corners) is formulated. Eight independent integral equations are obtained. They are solved individually by the method of iteration, and first-order formulae are obtained for the current distributions and driving point impedances. For each phase sequence, the sum of the symmetrical and antisymmetrical impedances gives the self-impedance and the difference between them gives the mutual impedance. Self and mutual impedances are also obtained for a superposition of the two phase sequences.

621.396.677.83

986 PASSIVE MICROWAVE MIRRORS. R.G.Medhurst.

Electronic Radio Engr, Vol. 36, No. 12, 443-9 (Dec., 1959).

It is shown that certain plausible assumptions concerning the near field of the primary aerial lead to quite a simple theoretical treatment applicable to a variety of shapes of reflector. Numerical gain values computed according to the present approach differ by less than 1 dB from both previously calculated and from measured values, except in the case of some earlier theoretical work on the rectangular reflector (see Abstr. 4454 of 1954), where measurement supports the present theory. This level of agreement is considered adequate, since neither the basic physical assumptions nor measurement accuracy would justify greater precision.

621.396.677.833

987 A NEW DESIGN METHOD FOR PHASE-CORRECTED REFLECTORS AT MICROWAVE FREQUENCIES. S.Cornbleet.

Proc. Instn Elect. Engrs, Monogr. 360E, publ. Feb., 1960, 11 pp. To be republished in Part C.

A method is given for the design of a class of wide-angle reflectors in which the aberrations are reduced by coating the reflector surface with a dielectric. At microwave frequencies this dielectric may take the form of an array of metal plates of waveguides and the constraint imposed by this form greatly simplifies the analysis. The path of the feed point is chosen so that only selected rays from it are equally phased. It is then found that both of the reflector's profiles and the path of the feed point can be described by a single parameter. The residual aberrations of several cylindrical systems, including the corrected parabola and circle, are analysed to find a reflector for which the scanning arc is the circle with centre at the vertex of the reflector. A refocusing procedure, which is found to be necessary, produces this scanning arc. Experimental results in agreement with this theory are given. It is shown that the design principle can be used to programme a step-wise procedure for the design of corrected surfaces using non-constrained natural dielectric coatings.

621.396.677.833.1

988 ANALYSIS AND REDUCTION OF SCATTERING FROM THE FEED OF A CHEESE ANTENNA.

W.A.Cumming, C.P.Wang and S.C.Loh.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 226-33 (July, 1959).

The far field of a cheese aerial can be described in terms of three components: (a) one due to the unobstructed aperture field; (b) one due to that portion of the primary feed energy not intercepted by the reflector; and (c) a scattered component due to the fact that the feed acts as an obstacle in the path of energy emerging from the reflector. This scattered component is usually calculated by considering a perturbation in the aperture field, in the form of an out-of-phase component sufficient to produce zero field in the geometrical shadow region behind the feed. A more exact analysis of a reflector excited by a longitudinally-slotted circular cylinder shows this engineering approach to be satisfactory, provided the out-of-phase component is assumed to exist over an area of width 1.5 times the projected width of the feed. An empirical investigation shows a similar result for a slotted rectangular-waveguide feed and for a horn feed. An aerial is described in which the scattered field and the back-lobe of the primary feed are made to partially cancel. An additional control over these field components is provided by a series of vanes or waveguides located either side of the feed.

621.396.677.833.2

989 A STUDY OF SPHERICAL REFLECTORS AS WIDE-ANGLE SCANNING ANTENNAS. Tingye Li.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 223-6 (July, 1959).

In order to keep the effects of spherical aberration within tolerable limits, the approach of using a restricted aperture is adopted. This approach is suitable for applications requiring very wide angles of scan. Experimental results show that the phase error over the illuminated aperture of a spherical reflector should not exceed one-sixteenth of a wavelength. This requirement determines the beamwidth of the primary source. A square-aperture horn with diagonal polarization is found to satisfy the requirements of a suitable feed for the reflector. Secondary patterns of a 10 ft-diameter hemispherical reflector illuminated by this horn at 11.2 kMc/s have a 3 dB beamwidth of 1.76° and a relative sidelobe level of about −20 dB throughout a total useful angle of scan of 140°. The measured gain is 39.4 dB, which is equivalent to the gain of a uniformly illuminated circular aperture of 31 in. diameter.

PROPAGATION . INTERFERENCE

621.391.812.3

990 A COMPLEX PERIODIC PATTERN OF SHORT WAVES. B.N.Singh and R.L.Ram.

J. geophys. Res., Vol. 63, No. 4, 873-5 (Dec., 1958).

Describes some complex fading patterns of signals at wavelengths of 16.83 m and 19.79 m received at Patna after transmission over a 900 km path from Delhi. The fading pattern exhibited a slow periodic variation of constant amplitude superposed on which was a a rapid periodicity of variable amplitude. This latter effect was attributed to interference of waves reflected from the F_2 and F_1 layers, (the vertical velocity of the F_2 layer at the time gave a periodicity of the right order) and to interference of singly and doubly reflected rays from the F_2 layer. The slow periodic variation arises due to interference of lower trajectory rays of ordinary and extraordinary waves reflected from the F_1 layer. G.D.Sims

621.391.812.33 : 551.5

991 POLARIZATION CHARACTERISTICS OF RADIO-WAVE PROPAGATION IN THE IONOSPHERE. Y.S.N.Murty.

Sci. and Culture, Vol. 25, No. 2, 161-2 (Aug., 1959).

Using the Appleton–Hartree formulae, equations are derived which describe the polarization of a radio wave propagated in the ionosphere. These equations are identical to those obtained by other workers using wave formulae. H.J.A.Chivers

621.391.812.44

992 SOME EFFECTS OF INTENSE SOLAR ACTIVITY ON RADIO PROPAGATION.

R.E.Houston, Jr, W.J.Ross and E.R.Schmerling.
J. atmos. terrest. Phys., Vol. 10, No. 3, 136-9 (March, 1957).

621.391.812.61

993 THE EFFECT OF PRECIPITATIONS ON RADAR CONTRAST. K.S.Shifrin and N.S Kokovin.

Radiotekhnika, Vol. 14, No. 9, 63-9 (Sept., 1959). In Russian.

Investigates analytically the effect of meteorological precipitations on the radar contrast of a target in the precipitation zone. The contrast function is considered over three parts of the information path: from target to radar input; from radar input to c.r.t. screen; and from the c.r.t. screen to observer.

P.Collins

621.391.812.62

994 STUDIES IN TROPOSPHERIC PROPAGATION BEYOND THE HORIZON.

A.B.Crawford, D.C.Hogg and W.H.Kummer.
Bell Syst. tech. J., Vol. 38, No. 5, 1067-178 (Sept., 1959).

Describes an extended series of experiments in beyond-the-horizon propagation on a 171 mile overland path using 460 and 4110 Mc/s. The following aspects of the propagation were investigated: the effect of aerial size on signal level and fading characteristics, wavelength dependence, seasonal and diurnal effects, a new form of diversity reception, the band-width capability of the medium. Many of the experiments were directed toward a better understanding of the mechanism of propagation.

621.391.812.621

995 COMPARISON OF COMPUTED WITH OBSERVED ATMOSPHERIC REFRACTION.

W.L.Anderson, N.J.Beyers and B.M.Fannin.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 258-60 (July, 1959).

Ray tracing methods have been applied in the computation of atmospheric refraction for a path at White Sands Missile Range, N. Mex., with a range of about 48 miles and an elevation angle of 14.5 mrad. The atmosphere was assumed to be horizontally stratified. Refractive index profiles were derived from meteorological data obtained from surface observations, wiresondes, radiosondes, and airborne refractometer soundings. The profiles were classified "A", "B", or "C", in descending order of reliability, prior to radar refraction computations. The classification system considered the variety of data available, the time lag between radar and weather observations, and the proximity of the sounding to the propagation path. A good correlation between observed and computed angles resulted and the correlation was directly related to the classification. Radar observations were made in the X-band and instrumental precision maintained to within 0.25 mrad. Total bending ranged between 0.56 and 2.23 mrad, with standard deviation 0.38 mrad. The r.m.s. deviation of computed from observed angles ranges from 0.19 to 0.41 mrad for Class A and Class C data, respectively. The correlation coefficient ranges from 0.81 to 0.13. It is concluded that within the limits of this experiment: (a) ray tracing methods are justified; (b) horizontal stratification may be assumed; and (c) the accuracy of bending predictions is increased by improving the meteorological data.

621.391.812.622

996 INFLUENCE OF AN ATMOSPHERIC DUCT ON MICRO-WAVE FADING. F.Ikegami.

I.R.E. Trans Antennas and Propagation, Vol. AP-7, 252-7 (July, 1959).

The results of continuous observation of a duct carried out

utilizing a tower 312 metres high are presented together with those of measurements of microwave fading conducted simultaneously. The variation of duct height with time, as well as the influence of the duct on fading for a horizontal and an oblique propagation path, are investigated in detail. A ray-theoretical analysis is given, indicating that fading may be attributed to the divergence or the convergence of radio waves and to the interference of two or more rays, caused by existence of a duct, or, more generally, of nonlinear M-profile. A comparison of calculation with experimental results shows that many of the characteristics of microwave fading are well explained by means of this interpretation.

621.391.812.624

997 MICROWAVE SCATTERING BY TURBULENT AIR. C.E.Phillips.
I.R.E. Trans Antennas and Propagation, Vol. AP-7, No. 3, 245-51 (July, 1959).

A system for measuring the power scattered by a region of thermally turbulent air is described, and its performance is analysed. The equipment used to generate the turbulent region and the temperature fluctuations therein is described. The experimental procedure can be summarized by stating that it consisted in measuring the fluctuations of the null in the interference pattern of an array composed of two aerials excited out of phase, when thermally turbulent air, of known properties, was interposed between the receiving and transmitting systems. The measured and calculated receiver response due to scattering by the turbulent air is compared, and it is noted that they agree at least within an order of magnitude. The experiment described shows that a measurement of the angular dependence of the signal scattered by turbulent air is within the possibilities of available techniques, although a more elaborate measuring system and higher microwave power levels would be required.

621.391.812.63

998 EXTRAORDINARY PROPAGATION CONDITIONS FOR ULTRASHORT WAVES. J.Ortner and A.Egeland.
Arch. elekt. Ubertragung, Vol. 13, No. 10, 420-8 (Oct., 1959). In German.

A short account is first given of observations at the Geophysical Observatory, Kiruna, Sweden, during the period from February,1958, to August, 1959, of (a) radio echoes from the northern lights, (b) tropospheric forward scattering of ultrashort waves, (c) interfering solar radiation due to strong solar eruptions. A more detailed account is then given of investigations, during the same period, of abnormal propagation conditions. During this period, 90 Mc/s signals from Langenberg, 200 km from Kiruna, were well received on five occasions, all of these in summer months. Discussion of all possible causes of this long-distance u.s.w. propagation shows that the most probable explanation lies in the existence of a sporadic-E layer from which the signals were reflected. A.Wilkinson

621.391.812.63

999 PROPAGATION OF H.F. AND V.H.F. IN THE ARCTIC REGION. R.Penndorf and S.C.Coroniti.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 121-5 (June, 1959).

All the available ionospheric records for stations located north of 60° geographic latitude and for the period 1954 to 1957 were critically analyzed. The F2 region shows two distinct types one, north of 75° with very little or no diurnal and seasonal variation in the critical frequency; the second, south of 70°N, exhibits diurnal and seasonal variations as well as thos correlated with sunspot activity. Communication by means of abnormal ionization, such as Es, is known. Three types of sporadic E abnormality were found; namely, the Thule type, the Auroral-Belt type, and the mixed type. These types show a distinct geographic distribution which is of utmost importance for planning communication links within the Arctic as well as between continental U. S. and the Arctic. Aurorae can be used as reflectors or scatterers.

621.391.812.63

1000 INTERFERENCE BETWEEN THE MAGNETO-IONIC COMPONENTS OF A SIGNAL REFLECTED FROM THE IONOSPHERE. Yu.L.Kokurin.
Radiotekhnika i Elektronika, Vol. 4, No. 9, 1434-8 (Sept., 1959). In Russian.

The periodic fading of a signal reflected from the ionosphere is shown to be attributable to horizontal drift of the ionospheric regions in which the effective levels of reflection of the magneto-ionic components are mutually tilted. A method is described for measuring the angle and direction of tilt and the speed of horizontal drift. The results given refer to frequencies of 7.2, 7.5 and 8 Mc/s. D.E.Brown

621.391.812.7

1001 PULSE PHASE-CHANGE SIGNALING IN THE PRESENCE OF IONOSPHERIC MULTIPATH DISTORTION.
S.G.Lutz, F.A.Losee and A.W.Ladd.
I.R.E. Trans Commun. Syst., Vol.CS-7, No.2, 102-10 (June, 1959).

Ionospherically propagated signals generally arrive by multiple paths having different and gradually changing time delays which cause multipath distortion. Interference fading and delay-difference smearing are the principle manifestations of this distortion. The technique of alternately transmitting (1-ms) and short (20-μs) pulses was developed to study multipath smearing and to determine whether the rates of change of phase would permit the use of phase-change signalling systems. Tests were conducted which confirmed the frequent occurrence of abrupt phase changes during reception of any one pulse, but established that the rate of phase-change between corresponding portions of successive pulses always was gradual. The phase-change signalling system that was developed as a result of this study is described. Data transmission (with millisecond pulses) over distances greater than 3000 km with negligible errors for prolonged periods was observed.

621.391.822

1002 RADAR DETECTION OF A "FLICKERING OBJECT" WITH A BACKGROUND OF CORRELATION NOISE. I. COHERENT BATCH OF SIGNALS. L.A.Vainshtein.
Radiotekhnika i Elektronika, Vol. 4, No. 5, 735-44 (May, 1959). In Russian.

Discusses mathematically the best receiver for detecting a batch of coherent signals reflected from a flickering object, i.e. signals subject to fluctuation due to slight changes in orientation of a complex reflecting object, in the presence of correlation normal noise due to chaotic reflections from multiple localized points in association, possibly, with ordinary receiver noise. The probability coefficient (defining the probability of the presence of a useful signal) is calculated and shows in which cases the receiver should subtract and those in which it should carry out coherent or non-coherent addition, etc. The probability of false alarms and correct detection is worked out for single- and two-channel cross-periodic difference receivers and enables a comparison to be made of the effectiveness of detection of constant and flickering objects with a background of heavy correlation noise. D.E.Brown

621.391.822

1003 RADAR DETECTION OF A "FLICKERING OBJECT" WITH A BACKGROUND OF CORRELATION NOISE. II. NON-COHERENT BATCH OF SIGNALS. L.A.Vainshtein.
Radiotekhnika i Elektronika, Vol. 4, No. 7, 1071-8 (July, 1959). In Russian.

See also preceding abstract. Discusses the best receiver for detecting a non-coherent batch of signals with a background of set noise or other normal noise having arbitrary correlation inside the signal repetition period but non-correlated from one period to the next. The probability coefficient is calculated and shows that the best receiver must add the results of optimum handling within the period following square-law detection in most cases (detection should be close to linear when the s.n.r. is large and the flickering strongly correlated). The probabilities of false alarm and correct detection are worked out and detection characteristics are drawn for rapidly and slowly flickering objects. D.E.Brown

621.391.823

1004 RADIO INTERFERENCE FROM POWER APPARATUS. O.Larsson.
Tekn. T., Vol. 89, No. 41, 1129-34 (Nov. 6, 1959). In Swedish.

The principles of interference suppression on power equipment are explained, and the use of capacitors (lead-through types), spark generators (resistance in series with capacitance), and screening for u.h.f. are dealt with. Safety problems connected with leakage currents due to the use of capacitors are discussed; Swedish rules require that the leakage current should not exceed 0.5 mA. The forms of interference from manually operated switches, thermostats, motors, fluorescent tubes, power lines and h.f. generators are then reviewed. G.N.J.Beck

621.391.827.4

1005 A REPORT ON INTERFERENCE CAUSED BY INTERMODULATION PRODUCTS GENERATED IN OR NEAR LAND MOBILE TRANSMITTERS. N.H.Shepherd.
I.R.E. Trans Vehicular Commun., No. PGVC-13, 16-19 (Sept., 1959).

621.391.832.22

1006 AUTOMATIC CONTROL OF DISTORTION IN WIDEBAND FREQUENCY MODULATED MICROWAVE LINKS. J.Tolman.
Electronic Engng, Vol. 31, 722-5 (Dec., 1959).

Discusses the problem of distortion generated in broad band f.m. links by non-uniform group-delay characteristics in r.f. amplifiers. An experimental equalizer-correcting group-delay slope is described and results obtained on a 600 channel circuit are given. Methods of correcting higher orders of distortion are indicated.

RADIO APPLICATIONS . RADAR

621.396.93 : 621.391.64

1007 INFRA-RED NAVIGATION AIDS: SOME APPROACHES TO INCREASED SAFETY IN BAD VISIBILITY. C.M Cade.
Brit. Commun. and Electronics, Vol. 6, No. 8-9, 592-8 (Aug.-Sept., 1959).

Reviews some experimental work to establish a short-range infrared navigation system for use in natural fogs and mists. Transmissions are within the range 4 to 14 microns. The principal need now is for sensitive, short time-constant, infrared image-forming devices for use in the receivers.

621.396.933.23

1008 ALL-WEATHER LANDING. J.L.Anast.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 75-7 (June, 1959).

The development of all-weather landing is reviewed, particularly with regard to automatic control aspects. Flare-out schemes are described as well as experience with various systems. Problems of cross wind and techniques for eliminating their effects are included, along the "weather cock" technique. Crab-angle elimination and castering cross-wind landing gear methods are touched upon.

621.396.933.23

1009 A SURVEY OF INSTRUMENT APPROACH SYSTEMS IN THE UNITED STATES. H.I.Metz.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 78-84 (June, 1959).

621.396.933.23

1010 IMPROVEMENTS ON THE INSTRUMENT LANDING SYSTEM. W.E.Jackson.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 85-94 (June, 1959).

Deals primarily with C.A.A. contribution to the art of instrument landing systems and is confined to the localizer and glide-path portions of the system. The present standard 8-loop localizer used at most sites as well as some modifications made in the basic localizer concept in order to adapt it to locations where siting problems exist is described. The standard glide slope as well as a new type of glide slope for use at extremely poor locations is also described.

621.396.933.23

1011 ELECTRONIC LANDING AIDS FOR CARRIER AIRCRAFT. A.Brodzinsky.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 95-9 (June, 1959).

A brief background of the problem is presented. The most recently developed fully automatic landing system consists of a three-coordinate tracking radar which provides closed-loop control through a ground-based computer, a ground-to-air data link and an autopilot in the aircraft. Recent successful sea trials indicate that the characteristics of this system are sufficiently accurate to provide a practical solution for the carrier landing problem.

621.396.933.23

1012 THE F.A.A. PHILOSOPHY AND PROGRAM OF INSTRUMENT APPROACH AND LANDING SYSTEM DEVELOPMENT. L.C.Wright and D.J.Sheftel.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 112-17 (June, 1959).

621.396.933.23

1013 A LOOK AT THE FUTURE OF AUTOMATIC LANDING SYSTEMS. G.B.Litchford, A.Tatz and F.H.Battle, Jr.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 118-28 (June, 1959).

621.396.933.23

1014 AN AUTOMATIC LANDING SYSTEM. F.D.Powell.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 128-35 (June, 1959).

The concept theory, implementation, and test results of the Bell Aircraft Automatic Landing system are presented. The system, which requires no additional airborne electronics equipment in land-based aircraft carrying an I.L.A.S. receiver and coupler, employs a precise ground-based radar and command computer. The major source of error of this closed-loop system is turbulence, while performance is limited chiefly by aircraft and autopilot properties. Flight-test results covering over 2000 automatic touchdowns and a variety of propeller and jet aircraft are presented for vertical and lateral degrees of freedom.

621.396.933.23

1015 REGAL — AN ADVANCED APPROACH AND LANDING SYSTEM. B.Cutler and L.Sanders.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, No. 2, 135-42 (June, 1959).

Ground-based scanning beams set up a broad reference grid in space from which aircraft may determine their position and optimumly determine the landing manoeuvre. A breadboard system was designed and tested in 1957 and 1958, and the F.A.A. experimental elevation system will be tested in 1959. Theory of the radar ground-reflection problem is discussed and empirical data are presented to validate conclusions.

621.396.933.23

1016 THE AN/MSN-3: AN AUTOMATIC GROUND-CONTROLLED APPROACH SYSTEM. H.Goldstein and B.Cutler.
I.R.E. Trans Aeronaut. Navig. Electronics, Vol. ANE-6, 142-8 (June, 1959).

A system is described whereby information gathered by a standard g.c.a. radar is utilized to compute automatically all g.c.a. approach-control commands; these commands are then transmitted simultaneously to a maximum of six aircraft via the U.S.A.F. frequency-division digital data link for automatic control of the aircraft approach. The system is designed to enable continuous human monitoring of the a.g.c.a. traffic-control operation and to include visual and aural warning signals in the monitoring system for added safety. Problems relating to optimum system response and gain parameters are discussed and control equations are defined. Results of extensive testing demonstrate a system capable of providing smooth control during the aircraft final approach under high-density traffic conditions. System accuracy is well within specified limits of ±50 ft in azimuth and ±30 ft in elevation at a minimum release point 100 ft above the runway.

621.396.946

1017 INFRARED COMMUNICATIONS RECEIVER FOR SPACE VEHICLES. W.E.Osborne.
Electronics, Vol. 32, No. 38, 38-40 (Sept. 18, 1959).

A circuit diagram is given of a fully transistorized infrared receiver. Two photoconductive cells are used, one of which acts as a reference. The cell output is chopped and amplified at a frequency of approximately 1 kc/s. Testing was carried out with a transmitter of the Xe—Hg type. It is mentioned that direct radiation from the sun may be rejected by a simple circuit which measures the rate at which the vehicle is closing on the sun. It is suggested that the advantage of infrared over radio is that during certain portions of the space journey heat generated within the vessel or solar heat could be used as a carrier. S.C.Dunn

621.396.946 : 621.391.63

1018 OPTICAL COMMUNICATION DURING HYPERSONIC RE-ENTRY. E.Langberg.
I.R.E. Trans Commun. Syst., Vol. CS-7, No. 2, 68-70 (June, 1959).

Communication during the re-entry of a space vehicle is a formidable problem because thermally-ionized gas in a shock wave surrounding such a vehicle absorbs the signal over the major portion of the radio spectrum. Some general features of re-entry communications are described. The entire electromagnetic spectrum is examined for selection of a suitable signal frequency.

621.396.946

1019 SYNTHETIC REPRESENTATION OF TERRAIN FEATURES ON A SIMULATED AIRBORNE RADAR DISPLAY. J.T.Slattery and M.Kamenetsky.
I.R.E. Trans Military Electronics, Vol.MIL-3, No.3, 75-82 (July, 1959).

Traces the development of the various techniques used to generate synthetic land mass or terrain radar signals for radar training devices. The survey begins with a description and assessment of Ultrasonic System and concludes with a discussion of the more flexible Two-Transparency System now under development by the Navy.

621.396.946

1020 A LAND-MASS RADAR SIMULATOR INCORPORATING GROUND AND CONTOUR MAPPING AND TERRAIN AVOIDANCE MODES. W.P.Jameson and R.M.Eisenberg.
I.R.E. Trans Military Electronics, Vol. MIL-3, No. 3, 105-14 (July, 1959).

Describes a method of simulating the radar displays of an airborne radar system. The simulator employs a scan-programmed vidicon tube and a low-power light source in conjunction with a three-dimensional terrain model to simulate radar return from land-mass formations, cultural areas, and target complexes. All effects of a moving aircraft, including velocity, heading, altitude, position, and attitude, are included in the simulation. This device will produce the displays for ground mapping, contour mapping and terrain clearance radar systems. It may be employed with an operational flight simulator or as a self-contained radar mission trainer for radar navigation and blind bombing operations.

621.396.96 : 621.316.728

TRANSISTORIZED POWER REGULATORS FOR AIRBORNE RADARS. See Abstr. 693

621.396.96 : 621.382.3 : 621.374.32

USE OF TRANSISTORS IN A DIGITAL CORRELATOR FOR PROCESSING RADAR INFORMATION. See Abstr. 839

621.396.96

1021 THE COMPARISON OF METHODS OF RADAR RECEPTION FROM THE POINT OF VIEW OF INFORMATION THEORY. F.P.Tarasenko.
Radiotekhnika, Vol. 14, No. 7, 63-70 (July, 1959). In Russian.

The superiority of information theory criteria over the simple idea of signal-to-noise ratio is demonstrated. Various published methods and the theory are briefly described. They are considered to form two main groups: those dealing with signals in real time and those which invoke a storage process. Channel capacities of various arrangements for continuous working are calculated when a number of different signal parameters are chosen. It is shown that, among methods using storage, thegreatest information is extracted by the method of sequential statistical analysis. S.C.Dunn

621.396.962

1022 PREDICTING RADAR DETECTION RANGE. J.S.Titus.
Electronic Industr., Vol. 18, No. 11, 80-6 (Nov., 1959).

Discusses in general terms the problem of defining radar detection range, outlines the fundamental ideas behind the radar range equation; and then applies these ideas to an airborne interception radar system. C.A.Hogarth

621.396.963

1023 AMPLITUDE-MODULATED VIDEO INTEGRATOR. R.E.Ellis and W.C.Rohlman.
I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 263-71 (1959).

An ultrasonic quartz delay line is used, as the basic storage medium, for the cumulative summation of radar video signals, within any possible range quantum. Pulses received, at the same range, from any one target are integrated by linear addition of amplitudes whereas the addition of noise signals is r.m.s. wise: a s./n. improvement therefore results. The radar trigger is derived by recirculation of a pulse in the same quartz line, on a different carrier channel, to ensure time correspondence of incoming with delayed signals. System operation, block schematic and circuit diagrams are given. Systematic trials have shown a 3 dB improvement in detection range for 50% probability of paint; the better contrast obtained on previously just-detectable signals gives a significant improvement in the performance of the human operator in the role of detector. Furthermore, the effect of non-locked interference pulses is drastically reduced, to the order of system noise level, by signal limiting, before summation, and non-integration due to the absence of range correlation; this effect is demonstrated with photographs. A.Reiss

621.396.963.325

1024 BETTER RESOLUTION THROUGH PPI SHADING. D.Levine.
Electronic Indust., Vol.18, No.11, 103-5 (Nov., 1959).

Following an analysis of the average charge density in an annulus of the display for slant range and ground range radial scans, a simple RC circuit is described which reduces the over-bright centre. The circuit slows the rise of a range gate which is applied to the video amplifier. W.G.Stripp

621.396.965.25

1025 CALCULATING THE PATTERN FOR SIDE-LOOKING RADAR. A.Montani.
Electronic Industr., Vol.18, No.11, 94-5 (Nov., 1959).

The radar equation is applied to an airborne radar with port and starboard aerials. Taking account of the number n of pulses on the target during the transit time t of the beam over the target, an expression is derived for the aerial gain required to keep the received power constant with varying range. This shows that the pattern should follow a cosec 3/2 law. W.G.Stripp

621.396.969.35

1026 DOPLOC USES PHASE-LOCKED FILTER. F.M.Gardner.
Electronic Industr., Vol. 18, No. 10, 96-9 (Oct., 1959).

The Doploc system uses a phase-lock loop in order to lock a v.c.o. (voltage controlled oscillator) to the frequency of a satellite tracking transmission. For a 108 Mc/s transmission the Doppler shift can be 6 kc/s. The Doploc can track over this band with a range of filter bandwidths between 1 and 50 c/s. The frequency of the transmission is given by the v.c.o. for accurate Doppler tracking. Two outputs are provided for the recovered a.m. and f.m. modulations. W.T.Blackband

621.396.969.35

1027 THE RADIO-ELECTRIC EMISSIONS OF ARTIFICIAL SATELLITES. E.Vassy.
Onde elect., Vol. 39, 647-53 (July-Aug., 1959). In French.

Transmissions of U.S.A. and U.S.S.R. satellites are described. These carry telemetry information, but in addition, information on air and ion densities at high altitudes may be obtained from records of received signals. An outline is given of the determination of air density from changes in satellite period determined using radio interferometers on Doppler beat receivers. The distribution of ionization above the F2 maximum of the ionosphere can be determined from observations either of Faraday fading or of the duration of radio signals during a transit. W.T.Blackband

621.396.969.35

1028 ARTIFICIAL-SATELLITE LISTENING POST AT THE R.T.F. CENTRE AT LIMOURS. G.Armier.
Onde elect., Vol. 39, 654-9 (July-Aug., 1959). In French.

The duration and the Doppler shift of the radio signals from artificial satellites have been recorded. The duration had a Rayleigh distribution. For all three Sputniks a plot of duration v. longitude of ascending node has a double hump. A description is given of the apparatus used for determining the Doppler shift. While many of the observed Doppler curves were smooth and consistent one with another, some others showed marked irregularities. W.T.Blackband

TELEVISION

621.397.3

1029 THE B.B.C. VISION ELECTRONIC RECORDING APPARATUS. P.E.Axon.
E.B.U. Rev. A, No. 49, 2-7 (May, 1958).

A magnetic tape equipment using $\frac{1}{2}$ in wide tape and running at 200 in/sec to provide a playing time of 15 min. The tape carries three tracks, two for vision and one for sound. The vision signals are divided into two bands, the 0-100 kc/s band being made to frequency-modulate a carrier for recording on one track and the 100 kc/s - 3 Mc/s band being recorded directly. Sound is recorded as a 250 kc/s carrier frequency-modulated by the audio signals. The heads have ferrite cores tipped with mumetal. The airgap is 2×10^{-5} in. long and a silicon monoxide coating ensures satisfactory gap spacing. The transport mechanism incorporates a tight-loop drive and the spool motors are automatically regulated to drive the tape at just under 200 in./sec when the capstan is not operating. Synchronism is achieved by painting a sine-wave pattern on the capstan flywheel, reflected light from which is directed on to a photocell. For editing purposes a cueing signal of 30 kc/s can be recording on the sound track by operating a key. H.G.M.Spratt

621.397.331.3

1030 AUTOMATIC WHITE- AND BLACK-LEVEL CONTROL FOR VIDICON FILM SCANNERS. E.Sennhenn.
Elektron. Rdsch., Vol. 13, No. 9, 319-23 (Sept., 1959).

A control circuit is described which adjusts the white level of film scanners automatically, thus balancing level fluctuations caused by variation of film highlights. A magnetic amplifier is used in the projector lamp circuit. For a luminous flux change of 1 : 3, the adjusting time is 1 to 2 s for an increase and 0.3 to 0.5 s for a decrease of flux, depending on the preadjusted lamp voltage range. The automatic black-level control keeps the signal of the darkest picture spot at a constant-voltage output signal. A special circuit locks the darkest point signal to the gradation characteristic.

621.397.335.1/.2

1031 MULTI-TRIODE FLYWHEEL SYNCHRONISING CIRCUIT FOR 525- AND 625-LINE RECEIVERS.
Mullard tech. Commun., Vol. 4, 284-7 (Aug., 1959).

The different requirements of a.f.c. circuits for 405-, 525- and 625-line systems are briefly discussed, and a circuit for use on the 525- or 625-line systems using a triode phase detector to control an anode-coupled multivibrator is presented. As with a previous circuit (see Abstr. 5598 of 1959), a particularly important feature of this arrangement is that wound components are not used.

621.397.61

1032 BAND III EXCITER UNIT WITH 275 W OUTPUT.
Mullard tech. Commun., Vol. 4, 275-7 (Aug., 1959).

A four-stage unit providing a 275 W output at 171 to 225 Mc/s is described. It can be used as an exciter, or (with slight modifications and rather lower output) as a vision transmitter.

621.397.61

1033 TELEVISION RETRANSMITTERS [TRANSLATORS] OF THE COMPAGNIE GÉNÉRALE DE TÉLÉGRAPHIE SANS FIL. M.Boxberger.
Onde elect., Vol. 39, 362-7 (May, 1959). In French.

Translators are used to provide coverage in areas not reached by the main transmitter signals and, for maximum coverage in mountainous countries, may greatly exceed the number of primary transmitters. A study of technical requirements and methods is made. A description is then given of the operation and performance, with block schematics and photographs, of the following: (a) translators with transmitted peak powers on the vision carrier of 0.3 to 3 W, corresponding to a.m. sound and other standards of sound modulation respectively. Type RE120 can receive one channel in either band I or III, the selected channel being retransmitted on another band I channel after suitable frequency-changing. Type RE 320 receives as above, but retransmits, after double frequency-changing, on a clear band III channel. (b) Translators type RE 123/RE 323 (3 to 20 W) comprise the above types with additional power stages: (c) Translators type RE 122/322 (500 W): the vision carrier is transmitted at 500 W, without intermediate demodulation, when working with a.m. sound, which is tapped off the i.f. amplifier, demodulated and then retransmitted via a conventional transmitter on a different frequency. For other sound modulation standards, both vision and sound are retransmitted on a single channel, as in (a) and (b). A.Reiss

621.397.62

1034 TIME-CONSTANT DETECTORS CONTROL TV SETS. K.R.Cross and R.O.Whitaker.
Electronics, Vol. 32, No. 36, 62-7 (Sept. 4, 1959).

Modern remote-control systems for TV set operation use shock-excited ultra-sonic resonators, with responding microphones, amplifiers and selective devices in receivers. The described system employs a single resonator, of which the time constant is varied in accordance with the desired operation. In the receiver a time detector produces a control pulse of duration proportional to the exponential decay. A brief analysis of the decay time and time-constant measurement is given, and a circuit, requiring one triode and four diodes, is shown which delivers an output pulse between 0.1 and 0.5 sec independent of the input amplitude. An alternative circuit, which measures decay slope rather than the time interval, is also described; it is more vulnerable to impulsive noise interference. A.Landman

621.397.621

1035 AN AMPLIFIED MEAN-LEVEL A.G.C. CIRCUIT.
Mullard tech. Commun., Vol. 4, 278-83 (Aug., 1959).

It is shown that the restricted maximum output may limit the signal a receiver can handle and at the same time the minimum amplitude of video signal is limited by the a.g.c. bias requirement. A simple amplified circuit is described which is free from these limitations and enables the full control range of variable-mu valves to be exploited automatically. The circuit does not use many additional components and is not critically dependent on valve characteristics.

621.397.621 : 621.373.544.1

1036 TRANSISTOR T.V. VERTICAL DEFLECTION. M.J.Hellstrom.
Semiconductor Prod., Vol. 2, No. 8, 21-31 (Aug., 1959).

After criticizing conventional circuits (i.e. based on therm. tube systems) resulting in excessive power drain and d.c. flow in the yoke, a novel circuit is proposed employing an a.c. coupled yoke and requiring two transistors and one diode only. The yoke is connected between the emitter of the first and the inductive collector load of the second transistor. A full description of the linearizing negative feedback circuit, all generated waveforms, yoke and transformer windings and other circuit components is given; stability and other design and performance data are also treated. A.Landman

621.397.828

1037 THE DEGRADATION OF TELEVISION IMAGES BY PARASITIC SIGNALS. L.Goussot.
Onde elect., Vol. 39, 352-61 (May, 1959). In French.

The various types of interfering signal, ranging from continuous mains ripple to random motor car ignition, are described and classified. The objective signal-noise ratio is established in each case. The parameters to be taken into consideration when assessing the subjective nuisance value of any particular type of interference are then studied. One approach to quantitative assessment is the comparison of the natural interference against artificial interference derived from a standard source. Finally, the importance of the frequency of the noise, when repetitive, and the form of pattern it produces on the screen, is investigated. H.G.M.Spratt

621.397.828

1038 THE DEGRADATION OF TELEVISION IMAGES BY PARASITIC SIGNALS. L.Goussot.
Onde elect., Vol. 39, 690-700 (July-Aug., 1959). In French.

See also preceding abstract. Random background noise alone is studied. The factors to be considered when assessing the subjective effect are briefly discussed. The relationships between the effective value of the noise, peak value, quasi-peak value and the probability of the peak value exceeding the quasi-peak value are analysed. Methods of measurement for determining these values are considered and figures obtained by various authorities quoted. Subjective comparisons between random noise and artificial interfering signals of a specific constant frequency, e.g. 1 Mc/s, are established and as a result the design of a weighting filter is worked out. H.G.M.Spratt

621.397.9

1039 AN ELECTRONIC POSITIONAL ASSIST FOR FILM READERS. R.N.Lewis.

I.R.E. WESCON Convention Record, Vol.3, Pt 8, 68-9 (1959).

Coordinates of tracks of nuclear particles in bubble chambers have been determined by taking films of the tracks in two planes at right angles, projecting these on a table surface and measuring the x and y coordinates of each. The method was not highly accurate and sustained operation caused fatigue. To assist in the reading a specially designed closed-circuit television monitor has been devised. A subminiaturized vidicon camera with appropriate linkages is mounted with its axis parallel to the plane of the table and a half-silvered mirror folds a small portion of the projected image ($\frac{1}{3}$ in.^{2}) so that it appears both upon the table and on the sensitive face of the vidicon. A crosshair reticle is cemented on the vidicon tube face. If now a 21 in. monitor tube is used to display the picture from the vidicon the optical magnification is 36 hence accuracy and positioning are greatly improved. With a colour monitor it is possible to provide mirror images (in different colours) of the scene thereby increasing the sensitivity of positioning in one direction. Positioning in the vertical direction of the vidicon consists in superimposing the two images, while positioning in the horizontal direction is accomplished by aligning with a reticle bar attached to the face of the vidicon. A block schematic is given showing the method of generating the sweep voltages for the vidicon and colour tubes. B.B.Austin

CONTROL . DATA PROCESSING

CONTROL AND SERVO SYSTEMS

621-5

1040 AN ALGEBRAIC CRITERION OF APERIODICITY OF LINEAR SYSTEMS. M.I.Romanov.

Dokl. Akad. Nauk SSSR, Vol. 128, No. 2, 291-4 (Sept. 11, 1959). In Russian.

An algebraic criterion of aperiodicity is derived, analogous in structure to the Routh–Hurwitz stability criterion. This applies to systems representable by a polynomial with real, positive coefficients. From these a discriminant may be formed, and in order that the roots of the polynomial should be real and negative it is necessary and sufficient that all the principal minors of this discriminant should be positive. Tables are given to assist in the formation of the discriminant. T.Horrocks

621-52

1041 OPTIMIZING CONTROL: THEORY AND PRACTICE. R.I.Van Nice.

A.I.E.E. Analog and Digital Instrumentation Conference Paper, 80-7. See Abstr. 3875 (1959).

A general discussion of the requirements for applying optimizing control in a continuous process. The approach followed involves a special purpose device rather than a mathematical model and a general purpose computer, and involves making some alteration to some of the process variables, waiting to see what the effect is, and then making another move. An initial application to a chemical process has indicated the feasibility of the approach. G.A.Montgomerie

621-52

1042 SELF-OPTIMIZING CONTROL SYSTEMS FOR A CERTAIN CLASS OF RANDOMLY VARYING INPUTS. A.P.Roberts.

Trans Soc. Instrum. Technol., Vol. 11, No. 3, 193-201 (Sept., 1959).

The control system input is assumed to consist of a message with noise superimposed. When the message and noise are uncorrelated and stationary in the statistical sense, the optimum system transfer function which minimizes the mean square error between message and output can be defined in terms of the spectral densities of the message and noise. The form of the optimum transfer function is determined by the shapes of the power spectra of the message and noise, but the parameters are determined by the mean square levels. Methods are proposed for designing systems which will automatically adjust the parameters to optimum values when the mean square levels of message and noise change slowly or infrequently. Methods are also suggested for constraining some quantity such as the output acceleration to a desired mean square value. The simulation of simple examples is described.

621-52

1043 SYNTHESIS OF THE EQUALIZING CIRCUIT FOR AUTOMATIC PHASE SYNCHRONIZATION. Z.Sobotka.

Slaboproudy Obzor, Vol. 20, No. 9, 548-55 (1959). In Czech.

The system considered consists of a phase detector, an equalizing circuit, a reactance valve and the synchronized oscillator. The input signal and the output of the oscillator are fed to the detector. It is shown that the operation of the system can be described by a nonlinear differential equation. In the case of small phase deviations, the equation can be linearized. The system is then described by means of a transfer function expressed by Laplace transforms. The equalizing network should be in the form of a quadripole consisting of two resistances and two capacitances. The transfer function comprises, therefore, a 3-degree polynominal in the denominator. Under the assumption that the response is oscillatory, the transfer function is used to determine the transient characteristics and the synchronization bandwidth of the system. The noise bandwidth of the system is also determined. The formulae are employed to design a practical synchronization system. The design is based on: (1) initial frequency difference between the oscillator and the input signal; (2) permissible phase error; and (3) permissible noise bandwidth. R.S.Sidorowicz

621-52

1044 A STABILITY CRITERION FOR NONLINEAR SYSTEMS. Y.H.Ku and A.A.Wolf.

Trans Amer. Inst. Elect. Engrs II, Vol. 78, 144-8 (1959) = Applic. and Industr., No. 43 (July, 1959).

By the application of the Taylor–Cauchy transform a stability criterion for nonlinear systems is derived. This criterion depends on the position in the complex plane of the singularities of the transform of the system time-response to the relevant time-input. An example is given. W.A.Cameron

621-52

1045 THE STABILIZATION OF CONTROL SYSTEMS WITH BACKLASH USING A HIGH-FREQUENCY ON-OFF LOOP. E.A.Freeman.

Proc. Instn Elect. Engrs, Monogr. 356M, publ. Feb., 1960, 8pp. To be republished in Part C.

Introduces a method of stabilizing control systems which have backlash in their control sequence. The technique described employs an auxiliary loop to drive the motor across the backlash whenever the motor and load tend to separate. Requirements of the auxiliary loop are deduced and a phase-plane analysis is developed for a second-order position-control system with this loop operative. Analysis shows that the system with backlash is effectively linearized. It is also shown that impacts between motor and load are avoided. To establish the feasibility of the method an analogue computer study is presented. Results from the analogue shows that the technique leads to considerable improvement in the step-function response. Variation of the system damping and of the ratio of inertias is also investigated. It is found that the system stabilized by the technique behaves essentially as a linear system.

621-52

1046 AN APPROXIMATION TO THE HARMONIC RESPONSE OF SATURATING DEVICES. R.J.Kavanagh.

Proc. Instn Elect. Engrs, Monogr. 353, publ. Jan., 1960, 7 pp. To be republished in Part C.

Derives an analytical expression for the describing function and for the Fourier coefficients corresponding to saturating systems which are excited by sinusoidal signals. The saturation characteristics are assumed to be symmetrical and single valued. The method involves an approximation of the actual system characteristic by means of an exponential curve. The results are given in the form of graphs of the fundamental and third-harmonic components of the system output and a graph of the system describing function. The latter will be of use in the analysis of non-linear feedback systems. A comparison is shown between the present method

and the technique of approximating saturation characteristics by means of straight lines. Formulae are given by means of which the higher-order harmonic components of the system output may be computed. Secondary results of this paper are Tables of the modified Struve functions $L_1(z)$ and $L_2(z)$ which are not available elsewhere in the literature.

621-52 : 621.395.625.3

1047 CHECKING [MAGNETIC] TAPED INSTRUCTIONS FOR MACHINE TOOL NUMERICAL CONTROL SYSTEMS.

V.Rogers.
Control Engng, Vol. 10, No. 10, 103-7 (Oct., 1959).

Tapes produced for numerically controlled machine-tools are replayed at the service centre on a "verifier", separate from the director, which records oscillographically the information on each of the 12 tape channels; the oscillograms are checked visually to detect errors in programming, computer, or tape.

A.O.Stanesby

621-52

1048 PROGRAMMED MACHINE TOOLS.
H.Neumann.
Tech. mod., Vol. 51, No. 8, 440-8 (Aug., 1959). In French.

A brief general discussion. A.O.Stanesby

621-52

1049 SHAFT ANGLE ENCODERS AFFORD HIGH ACCURACY.
C.F.Winder.
Electronic Industr., Vol.18, No.10, 76-80 (Oct., 1959).

Optical shaft encoders with straight or cyclic binary coded output are described with accuracies of the order of 1" of arc (18 binary digits, 16.5 in. diameter). A.O.Stanesby

621-52

1050 WEIGHING TECHNIQUES FOR AUTOMATIC PRODUCTION LINES. A.L.Hendon and G.C.Chapman.
Trans Soc. Instrum. Technol., Vol. 11, No. 3, 154-9 (Sept., 1959).

The need for high-speed weighing equipment is outlined and the general methods of operation are surveyed with particular reference to the electromagnetic force-balance check-weigher. Factors affecting the design of this type of weigher are discussed in some detail, and an example of an actual installation is described, in which biscuit packets are check-weighed at 90-100 packets per minute to an accuracy of about 0.2%.

621-52

1051 A PUNCHED-CARD-CONTROLLED COMPONENT-PART INSERTION MACHINE. H.K.Hazel.
I.R.E. Trans Prodn Tech., No. PGPT-5, 39-42 (Aug., 1959).

621-526

1052 THE ANALYSIS OF VALVE-CONTROLLED HYDRAULIC SERVOMECHANISMS. R.G.Rausch.
Bell Syst. tech. J., Vol. 38, No. 6, 1513-49 (Nov., 1959).

The nonlinear equations that represent the behaviour of valve-controlled hydraulic servomechanisms are derived, and the assumptions necessary for their linearization are discussed. Solutions of the nonlinear equations obtained by analogue computation are compared with solutions of the linear equations. Attention is drawn to the influence of the hydraulic parameters on the nonlinear closed-loop system behaviour.

621-526

1053 SENSING R.M.S. VALUES FOR SERVO SYSTEMS.
R.L.Phillips.
Electronic Industr., Vol.18, No.10, 91-3 (Oct., 1959).

Describes a sensing element capable of reacting to the r.m.s. value of an interrupted sine wave. The r.m.s. value can be synthesized by using a magnetic amplifier to sum appropriate fractions of the average and peak values of the sine wave. These values are themselves determined in the magnetic amplifier by means of bridge–rectifier and bridge–rectifier-capacitor circuits. Such an element might be useful to control the pulsed r.m.s. voltage used to heat the filament of a pulsed oscillator. G.D.Sims

621-526 : 621.395.625.3

1054 AN ELECTRO-SERVO CONTROL SYSTEM CAPABLE OF CORRECTING ZERO POINT ZERO FIVE MICRO-SECOND ROTATIONAL ERRORS. W.Barnhart.
I.R.E. Nat. Convention Record, Vol. 7, Pt 7, 124-9 (1959).

This control system is incorporated in the Ampex Videotape recorder. It corrects the errors arising out of variations in the horizontal positioning of the female guide at the rotating drum, these errors causing a Venetian-blind effect in the reproduced picture. Error signals are derived from a comparison between (a) the time interval between the last synch. pulse prior to head switching and the first pulse after head switching and (b) the time interval between the first and second pulses after head switching. The error signal is used to energize a motor which controls the horizontal position of the female guide. H.G.M.Spratt

621-526

1055 THE HUMAN DISORIENTATION DEVICE—A SIMULATOR OF ANGULARLY-ACCELERATED MOTION.
J.H.Achilich.
I.R.E. Trans Military Electronics, Vol. MIL-3, No. 3, 99-104 (July, 1959).

The human disorientation device has been developed as a research tool in the field of aviation medicine for the generation of angularly accelerated motion to enable the accomplishment of medical research in the field of animal or human responses to angular acceleration. The device will produce accurately known and controlled values of angular acceleration about two axes of rotation when the subject is seated so that his head is located at the point specified by the intersection of the axes. The human disorientation device will allow medical research in the field of sensory responses to angular acceleration, vertigo, and similar phenomena required for an analysis of human behaviour and human performance limitations in the rapid manoeuvering (spin and tumbling, etc.) of high-speed aircraft and spacecraft.

TELECONTROL . TELEMETERING

621.398

1056 CIRCUIT DESIGN USING MAGNETOSTRICTIVE FILTERS. A.P.Thiele
Electronics, Vol. 32, No. 25, 72-4 (June 19, 1959).

Describes narrow-band filter banks and their use in telemetry, for noise reduction in radar systems, and for Doppler radar.

J.Thewlis

621.398

1057 ENVIRONMENTAL TESTING OF FUTURE SPACEMEN.
M.Traite, W.Welkowitz, J.Kilduff and C.Purpuro.
Electronics, Vol. 32, No. 42, 65-9 (Oct. 16, 1959).

The design of telemetering systems for extreme conditions of space travel is discussed. The physiological factors considered are respiration rate, pulse rate, temperature, blood pressure, heart sounds, skin resistance and E.E.G., and details are given of the essential design of transducers, their optimum positions on the body and the best means of compiling data suitable for remote transmission. F.T.Farmer

621.398

1058 TELEMETERING EQUIPMENT.
S.T.Lyngsø.
Ingeniøren, Vol. 68, No. 19, 557-70 (Oct. 1, 1959). In Danish.

A comprehensive review of electrical systems treating first the standardization of the telemetering current, position-indicating equipment and the electromagnetic transmitting unit coupled to the measuring instrument at the sending end. Temperature telemetering from resistance thermometers and thermocouples, current and voltage transmitters, the use of telephone lines and special terminal equipment are discussed. Telemetering by the frequency variation and pulse-frequency methods are considered, with notes on the receiving and transmitting equipment required. The number of telemetered data can be appreciably increased by cyclic scanning of the various measured values using two synchronous shifters, one at the receiving, the other at the sending end. All these methods being essentially anologue methods, telemetering by a digital system with encoder and decoder is discussed. G.N.J.Beck

621.398

1059 A TIME REDUNDANCY INSTRUMENTATION SYSTEM FOR AN I.C.B.M. RE-ENTRY VEHICLE.
R.E.Schmidt, J.R.White and R.A.Porter.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 127-34 (1959).

High-temperature gases engendered during re-entry of the vehicle into the earth's atmosphere cause ionization "black-out" with the result that r.f. transmission of data during this period is seriously impaired. To overcome this weakness, the telemetry equipment in the vehicle, which operates on an amplitude-modulated f.m./p.m. system, is made up of two sections. Section No. 1 includes a group of six sub-carrier channels which are combined to drive transmitter No. 1. In addition, the combined sub-carrier signal is fed into a dual-channel record-retransmit unit in Section No. 2 This unit consists of an endless-loop tape recorder. After a delay corresponding to the anticipated re-entry black-out time, the signal from the recorder is applied to transmitter No. 2. Thus all data, except that collected just prior to black-out and to impact, are transmitted twice. The recorder, power control, aerial and r.f. system and other features are also described. H.G.M.Spratt

621.398

1060 CENTRALIZED TELECONTROL OF HIGH- AND MEDIUM-VOLTAGE DISTRIBUTION NETWORKS.

Votre Electricite, Vol. 30, 33-43 (Dec., 1959). In French.

621.398 : 621.396.933

1061 CONTROL SYSTEM FOR A PILOTLESS TARGET AIRCRAFT. E.H.Hall.

Brit. Commun. and Electronics, Vol. 6, No. 8-9, 606-9 (Aug.-Sept., 1959).

A brief account is given of the system used to control a pilotless jet aircraft which is used as a target for guided weapon trials.

621.398 :656.25

1062 SINGLE-TRACK DIRECTIONAL INTERLOCKING. J.Lapierre.

Rev. tech. C.F.T.H., No. 30, 49-57 (March, 1959). In French.

Modern railway electrification with central control and electric block signalling requires an improved method of control to enable maximum traffic to be operated, including safety of operation of two-way traffic over single tracks. A latching or contacting device feeds a.f. signals with band frequency filters for transmission over common lines; transistors make this readily possible. At one station the transmitter uses a carrier of 1 kc/s modulated at 30 c/s, associated with a receiver sensitive to 1.5 kc/s modulated at 70 c/s. The remote station has the reverse frequency characteristics and four combinations are possible. A d.c. supply of 22-30 V is needed and the transmitter power is only 20 mW. A temperature range of −20 to +50 deg C is covered and the line loss may be 15 dB. The transistors used are germanium, of listed types. The installation serves three sections of the Dole–Valorbe route, and is satisfactory. E.H.W.Banner

621.398 : 681.142

A HIGH-SPEED, AIRBORNE DIGITAL DATA ACQUISITION SYSTEM. See Abstr. 603

621.398

1063 A UNIQUE RADIO SYSTEM FOR FLOOD FORECASTING. W.C.Wray.

I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 9-18 (1958).

Frequent and devastating floods in the State of Pennsylvania have led the government to instal automatic water-level indicators which transmit readings to a central control point. Similarly rainfall or melted snow indications are given. Because of the importance of this flood control network the system is provided with automatic failure alarms as well as interrogating equipment to locate the sources of failure. In addition to the automatic circuits there are 32 voice communicating stations working in the 890-960 Mc/s band. A map and layout of the whole system is given; also functional block diagrams and photos of the consoles, water-level transducer and rain gauge equipment. B.B.Austin

COMPUTERS . APPLICATIONS

(Refer also to Digital circuits . Switching circuits)

681.142

1064 ELECTRONIC COMPUTERS. N.Röthlisberger.

Schweiz. tech. Z. (S.T.Z.), Vol. 56, No. 42, 849-57 (Oct. 15, 1959). In German.

Describes the basic differences between digital and analogue computers. A brief outline is given of binary coding and logical circuitry, and special reference is made to ERMETH, a comparatively slow and simple digital computer, the first to be designed and constructed in Switzerland. A.E.I. Research Laboratory

681.142

1065 UNIFORM COOLING AIR FLOW DURING COMPUTER MAINTENANCE AND OPERATION. A.Perlmutter.

I.R.E. Nat. Convention Record, Vol. 7, Pt 6, 148-57 (1959).

Two existing methods of air cooling are first described — one a sucking and the other a pressure system. Both suffer from undesirable air temperature differentials per unit height, air seals are needed and special provisions for debugging are required. In the latter case if packages are removed for any purpose the air distribution is altered and hot spots develop. Sylvania has developed a system to overcome these difficulties which is applicable to other purposes. Each computer rack is divided horizontally by 11 hollow shelves, each shelf having 12 slots in it from front to back. Between each pair of shelves which are about 8 in. apart a computer package can be pushed, these being thus mounted vertically in rows of twelve. The hollow shelves are all sealed at one end and the other end is connected to a duct up the side of the rack and this is fed with air under pressure from a blower. On the upper side of each shelf a pair of holes are cut close to each vertical package. The holes act as nozzles and the air shoots through them to impinge on the shelf above from which it is scattered evenly over the package. The compartment is sealed at one side where the packages plug into their sockets but the other side is open so that the air flows past the length of the package and out to the atmosphere. The cooling capacity of each rack was 1741 watts and 350 cu. ft. of air passes through each minute. Air-flow diagrams and photos of each rack at various stages of construction are given. B.B.Austin

681.142

1066 AN APPROACH TO AIRBORNE DIGITAL COMPUTER EQUIPMENT CONSTRUCTION. P.E.Boron and E.N.King.

I.R.E. Trans Prodn Tech., No. PGPT-4, 18-21 (June, 1959).

One method of building airborne digital equipment is discussed, which makes use of the modularized etched-wiring plug-in philosophy, and which utilizes an all-etched wiring harness to accomplish the entire complex of connections between plug-in units. Of a possible 364 external connections, 183 are actually brought to a possible 1716 connector contacts. These contacts, and their associated printed wiring, tie together 32 flip-flop modules and 17 diode-gating etched-pattern matrix arrays, without the use of a single piece of conventional wiring. Points of emphasis are miniaturization, reliability, small weight, accessibility, and manufacturability of the equipment.

681.142

1067 THE CONCEPT OF THE SIEMENS 2002 DIGITAL COMPUTER. W.Heimann.

Entwicklungs-Ber. Siemen and Halske, Vol. 22, 9-15 (Oct. 1959 Sonderheft). In German.

Emphasizes the relationship between the operating mode, coding of numbers, and basic features of arithmetic and logical operations and considers word length and structure of number and instruction words. The data flow between arithmetic and control unit, storage sections and input-output equipment is outlined and possible applications of time-shared operation are especially emphasized.

681.142

1068 THE CODE SYSTEM OF THE SIEMENS 2002 DIGITAL COMPUTER. H.Gumin.

Entwicklungs-Ber. Siemen and Halske, Vol. 22, 16-22 (Oct., 1959 Sonderheft). In German.

Describes the representation of numbers and instructions, address modifications through index registers and address substitution, relative coding possible by using the instruction counter as an

index register, as well as instructions and operating speed of the computer. In the section discussing operating speed it is emphasized that the 2002 digital computer is capable of performing a number of operations (especially those of the input–output type) concurrently with operations proceeding in the central control unit, the arithmetic unit and other input–output units.

681.142

1069 DESIGN AND OPERATING PRINCIPLE OF THE ARITHMETIC UNIT OF THE SIEMENS 2002 DIGITAL COMPUTER. R.Veelken.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 23-33 (Oct., 1959 Sonderheft). In German.

The arithmetic unit is constructed from simple modular functional units which can be classified as registers, logical interconnection units, switches and control elements. The features of these basic building blocks, construction of the arithmetic unit from the latter and interoperation of individual sections of the system upon executing the instructions are described.

681.142

1070 THE CONTROL UNIT OF THE SIEMENS 2002 DIGITAL COMPUTER. C.Hackl.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 34-9 (Oct., 1959 Sonderheft). In German.

Describes the necessary conditions and requirements placed on the control unit of the computer, together with design principles.

681.142

1071 HARDWARE, LOGICAL CIRCUITRY AND MEMORIES OF THE SIEMENS 2002 DIGITAL COMPUTER. K.Gosslau.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 40-8 (Oct., 1959 Sonderheft). In German.

The quality of a data processing system is determined by its logical design and its hardware. Development has concentrated on input–output equipment and switching circuits and memories. Solid-state elements are now in common use, with semiconductors preferred as switching elements and ferromagnetic materials used for data storage. The primary feature of the computer is its completely transistorized circuits. Logical functions are realized by switching circuits using dynamic circuit techniques and those of the RCTL type. A core memory is employed as high-speed working-store; units with a 10^4 word maximum capacity (0.5×10^6 bits) with 5 μs access time have been developed. Magnetic-drum and magnetic tape memories have even greater data storing capabilities and serve as backing stores for the 2002 computing system.

681.142

1072 DYNAMIC SWITCHING CIRCUIT TECHNIQUE FOR THE SIEMENS 2002 DIGITAL COMPUTER. W.Feissel.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 49-54 (Oct., 1959 Sonderheft). In German.

The arithmetic and control unit of the computer is constructed from dynamic circuits, which are designed to process binary signals in the form of voltage pulses. The circuits are synchronized through a system of clock pulses consisting of four equally spaced identical clock elements. Gate circuits used for performing logical interconnections are constructed from resistors and diodes and interoperate with two-stage transistor amplifiers which can drive up to 8 gate inputs. The clocking system requires the application of a timing circuit which permits signal pulses generated at different instances to be brought to coincidence. The pulse delay circuit of the one-bit register operates in a similar manner to the timing circuit. It delays each signal pulse by a full clock interval, and like the timing circuit can drive up to 8 gate inputs. The circuits are exclusively equipped with junction transistors of the TF 65 type ($f_\alpha > 600$ kc/s) and the TF 65 s type ($f_\alpha > 1.2$ Mc/s).

681.142

1073 THE RCT SWITCHING CIRCUIT TECHNIQUE OF THE SIEMENS 2002 DIGITAL COMPUTER.
K.Braun and H.J.Harloff.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 55-62 (Oct., 1959 Sonderheft). In German.

Logical design with RCT elements is described with the aid of examples taken from the data stores of the 2002 computer. Several identical RCT elements are assembled on plug-in circuit boards of the etched-wiring type. Conservative operating tolerances of the individual RCT elements ensure high reliability of larger units constructed from the latter.

681.142

1074 THE MAGNETIC-CORE STORAGE OF THE SIEMENS 2002 DIGITAL COMPUTER. F.Ohmann.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 63-73 (Oct., 1959 Sonderheft). In German.

After outlining the operating principles of magnetic-core storage units operating on the coincident-current principle, the construction of a 1000-word storage is described. The type of address selection chosen for the 1000 core storage locations, each comprising 52 bits, makes possible, together with parallel data transfer, an access time of 5 μs. Control circuits and the asynchronous-type clock circuit are designed for a cycle time (read and write operation in the storage unit) 14 μs. The 52 000 cores are arranged in core storage blocks each comprising 26 memory planes. Each memory plane contains $20 \times 50 = 1000$ cores. Four wires thread each core. All switching circuits of the core storage control are transistorized. During a life test under operating conditions greater than those for normal operation of the computer, 10^{12} bits were read into and out of the core storage without error.

681.142

1075 THE MAGNETIC-DRUM MEMORY, A BACKING STORE FOR THE SIEMENS 2002 DIGITAL COMPUTER.
K.Braun and W.Kayser.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 74-84 (Oct., 1959 Sonderheft). In German.

The 10 000-word magnetic-drum memory is employed as backing store. Between the latter and the magnetic-core, working memory data can be transferred in blocks of arbitrary length. Prior to a block transfer, the drum memory is told the block length (number of words) and the start address (address of the first word) through special instructions in the programme. The block transfer is initiated in the desired direction by a write or read instruction, respectively. A track selecting unit interconnects the selected magnetic heads with read-write circuits and enables continuous transfer of long blocks. The access time to the drum (19 ms on the average) comes into effect only once during a block transfer operation. The information is recorded using the "non-return-to-zero" technique. Transistors supply the write currents and amplify the read signals. The read-out signals of two timing tracks provided on the drum are used for synchronizing the RCT switching circuits of the drum memory and the switching circuits of the whole computer.

681.142

1076 THE MAGNETIC DRUM OF THE SIEMENS 2002 DIGITAL COMPUTER. R.Otto.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 85-92 (Oct., 1959 Sonderheft). In German.

The magnetic storage drum has a light-alloy rotor of 400 mm diameter which rotates around a vertical shaft provided with backlash-free ball bearings. The eccentricity of the drum surface and the unbalance amount to a few μm only. The lower part of the cast housing supports the bearing and driving motor and the upper part of the housing carries the eight rows of magnetic heads. The ferrite-core magnetic heads are individually adjustable. The gap width approximately equals the spacing between the heads and the oxide coating. The magnetic heads are electrically and mechanically checked before insertion. Their spacing from the drum surface is so adjusted that the correct reading voltage is obtained. The characteristic data of the drum are given.

681.142

1077 CONNECTION OF PUNCHED-TAPE, PUNCHED-CARD, AND MAGNETIC-TAPE EQUIPMENT TO THE SIEMENS 2002 DIGITAL COMPUTER. H.Donner and K.Leipold.
Entwicklungs-Ber. Siemen and Halske, Vol. 22, 93-100 (Oct. 1959 Sonderheft). In German.

Punched-tape, punched-card, and magnetic-tape equipment may be used. Individual characters on the punched tape can be processed one at a time or word by word. Data transferred between punched-card and magnetic-tape equipment and the computer pass through magnetic-core buffers. Punched-card and magnetic-tape characters can be individually written into and read out of a buffer under control of the computer. Each punched-card machine is assigned a card buffer whereas several magnetic-tape units can be connected to one magnetic-tape buffer. Independent control units enable concurrent operation with several punched-card machines and magnetic-tape units while the control unit of the computer performs further programme steps. Out of 32 punched-tape, punched-card and magnetic-tape instructions, 9 instructions are used for punched-tape operation.

Out of 23 instructions for punched-card and magnetic-tape operation, there are 13 common and identical buffer instructions, whereas 10 instructions are special magnetic-tape instructions.

681.142

1078 CONNECTION OF INPUT AND OUTPUT EQUIPMENT TO THE SIEMENS 2002 DIGITAL COMPUTER.

F.Obst and H.Unger.

Entwicklings-Ber. Siemen and Halske, Vol. 22, 101-6 (Oct., 1959 Sonderheft). In German.

Building blocks specialy developed for connection of mechanical equipment are completely transistorized and are generally constructed in the form of printed circuit cards.

681.142

1079 THE CONSTRUCTION OF A DIGITAL-COMPUTING SYSTEM FROM A BASIC TRANSISTOR CIRCUIT.

P.L.Cloot and G.E.Jackson.

Electronic Engng, Vol. 32, 37-43 (Jan., 1960).

It is possible to build a complete digital-computing system by interconnecting a number of identical basic circuits. One method uses a basic circuit consisting of one transistor, one capacitor and three resistors, and a special-purpose computer with a built-in programme for binary–decimal conversion has been constructed to demonstrate the application of the method. An account is given of the logical design of this machine, of the circuit design, and of its mechanical construction. It has proved possible to use printed wiring throughout, and to make the computer extremely compact.

681.142 : 621.395.625.3

1080 THE MAGNETIC DRUM STORE OF THE "MERCURY" COMPUTER. K.I.Turner and J.E.Thompson.

Electronic Engng, Vol.32, 16-21 (Jan., 1960).

The universal high speed computer, "Mercury", has at its main store a number of magnetic drums (up to 8 in all) capable of storing 1½ million bits of information. Each of these is housed along with all necessary circuits in a self-contained cabinet. Electronic track selection on writing and reading allows switching between tracks to be carried out in less than 20 μs. Synchronism between the drum and the computer is achieved by means of an electronic system of speed control.

681.142

1081 A DIGITAL COMPUTER STORE WITH VERY SHORT READ TIME. T.Kilburn and R.L.Grimsdale.

Proc. Instn. Elect. Engrs, Paper 3178M, publ. Jan., 1960, 6 pp. To be republished in Vol. 107B, 1960.

Describes the principles of operation and the construction of storage units with a very short access time for reading. One form of the store which has been constructed has a capacity of 200 000 bits of permanent information and another has been built with a capacity of 1000 000 bits, the whole contents of which may be changed in under one minute. The technique employed permits the construction of very large stores at low cost. Each digit cell is formed, basically, by two sets of winding which form the primary and secondary of a transformer and the two binary states are determined by the pressure or absence of a piece of linear ferrite material coupling the windings. The access time is largely determined by the physical size of the store and the speed of operation of the associated circuits; a time of 100 millimicrosec is typical.

681.142

1082 STATISTICAL ANALYSER MAINLY COMPOSED OF PARAMETRONS.

S.Oshima, H.Enomoto and S.Watanabe.

J.Inst. Elect. Commun. Engrs Japan, Vol.42, No.8, 744-9 (Aug., 1959). In Japanese.

Describes the construction and operation of an analyser suitable for the digital computation of correlation functions, probability density, cumulative probability, Fourier transforms, mean-square values, weighted-mean values, etc. About 1500 parametrons are used as the main logical elements. The required type of calculation can be selected by the operation of push-button switches. The data on which the calculations are based are fed to the analyser by means of punched tape. The results obtained are indicated on 10 double-pulse dekatron counters. Auxiliary equipment for assisting in the investigation of radiowave propagation data includes a newly developed curve reading and coding apparatus. A.Wilkinson

681.142

1083 PROCESSING DATA IN BITS AND PIECES. F.P.Brooks, Jr, G.A.Blaauw and W.Buchholz.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 118-24 (June, 1959).

A data-handling unit is described which permits binary or decimal arithmetic to be performed on data fields of any length from one to sixty-four bits. Within the field, character structure can be further specified: these processing entities, called bytes, may be from one to eight bits long. Fields may be stored with or without algebraic sign. On all operations, the relative offset or shift between the operand from memory and that from the accumulator can be specified. Besides the arithmetic operations, three new logical instructions allow any of the sixteen logical connectives of two variables to operate upon each pair of bits in the memory and accumulator operands. The variable field length, variable byte-size features, extend the use of connective operations to a surprisingly wide variety of logical, house-keeping, and editing tasks. These arithmetic and connective instructions are general and powerful programming tools which greatly simplify complex manipulations. Programming of typical tasks, with both the new instructions and with the instruction set of a conventionally organized computer, has shown that the new set requires substantially fewer instructions to be written, stored, and executed. Furthermore, the new instruction set has considerably fewer distinct operations than the more conventional set. This is possible because the general-purpose instructions of the new set replace many ad hoc instructions which deal with pieces of instructions or data words, or which perform shifting, packing, or editing functions. The initial application of the variable field length data-processing unit is in the I.B.M. Stretch computer.

681.142

1084 INCREASING RELIABILITY BY THE USE OF REDUNDANT MACHINES. D.E.Rosenheim and R.B.Ash.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 125-30 (June, 1959).

The improvement of reliability and availability through redundancy of entire machines rather than of components is investigated. An attempt is made to break down the cost of operating a digital computer, and to determine the relationship between cost and system failure. Three specific cases are discussed. Case 1: Where n machines are operated independently, processing the same input data. The output is taken from a single one of them; if this machine fails, the output is promptly switched to a machine which is operating properly. As soon as repairs can be completed, the machine which had failed is returned to operation. System failure occurs only when all n machines are in the failed condition at the same time. A penalty cost is assessed for system failure, this cost being proportional to the system down-time. Case 2: Where n machines are operated as in Case 1, except that any machines which fail are not returned to operation until the beginning of the next operating period. Penalty cost for system failure is assessed in the same way as in Case 1. Case 3: Where n machines are operated as in Case 2, but where the penalty cost for system failure is a fixed amount and is independent of the resulting down-time.

681.142

1085 THE RESIDUE NUMBER SYSTEM. H.L.Garner.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 140-7 (June, 1959).

A novel number system called the residue number system is developed from the linear congruence viewpoint. The residue number system is of particular interest because the arithmetic operations of addition, subtraction and multiplication may be executed in the same period of time without the need for carry. The main difficulties of the residue code pertain to the determination of the relative magnitude of two residue representations, and to the division process. A discussion of the arithmetic operations and the conversion process required to convert from a residue code to a weighted code is given. It is concluded that in its present state the residue code is probably not suitable for general purpose computation but is suitable for a special class of control problems. Further research in both components and arithmetic is required if a residue code suitable for general purpose computation is to be obtained.

681.142

1086 A SYSTEMS APPROACH TO INTEGRATION OF AUTOMATIC DATA PROCESSING AND COMMUNICATIONS. W.F.Luebbert.

I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 223-30 (1959).

A general description of the principles behind and the principal

items of the U.S. Army FIELDATA family of data processing and communications equipment. A general concept postulates a data-handling system capable of performing transformations of which conventional one-location data processing is one special case and conventional no-processing data transmission is another special case. The equipment consists of: input-output transducers for converting information from its source form into an appropriate digital form; transmission transducers for converting digital data into appropriate signals for transmission over radio or other links; and "embolic" equipment to perform communications supervision, error control, and cryptographic security functions. The data handled is classified into primary information, which the user wishes transferred, and secondary information used only by the communications equipment and personnel. The embolic module need understand only secondary data so long as it can recognise primary data and transmit it unchanged. There is a thorough discussion of error control and brief descriptions of specific equipment such as transmission transducers, general purpose computors (MOBIDIC, BASICPAC/LOGICPAC, INFORMER/DATA COORDINATOR), and special embolic equipment (cryptosecurity adaptor, control equipment, data concentrator). In-out transducers such as the electric typewriter, paper-tape reader, paper-tape punch, high-speed printer, paper-tape transport, magnetic tape transport, and Tacden are also mentioned.

G.A.Montgomerie

681.142

1087 HEADQUARTERS COMPUTATION CENTRE FOR THE H.E.P.C. OF ONTARIO.
THE DESIGN OF THE DATA COMMUNICATION NETWORK.
W.H.Sanders;
COMMUNICATIONS BETWEEN REGIONAL OFFICES AND THE HEAD OFFICE AND THE TAPE SORTING OPERATION.
S.J.Crossman;
THE TAPE MESSAGE SORTER. J.Rywak;
COMMUNICATIONS BETWEEN H.E.P.C. OF ONTARIO AREA OFFICES AND REGIONAL OFFICES USING THE AUTOSCAN SYSTEM.
H.R.W.Davis.
Engng J., Vol. 42, No. 8, 43-7, 47-9, 49-55, 55-9, 65 (Aug., 1959).

The first part is concerned with the design of the data communication network by which certain data can be transmitted from 103 operating areas to 9 Region offices from which in turn, after auditing, the data is sent on to head office. Five-channel punched paper tape is used in these stages and the data is then transferred to magnetic tape as input to the data processing centre. The output is printed and posted back to Area and Region offices. Each Area office is equipped with tape preparation and transmitting equipment, each Region office is also equipped with a sequencing device which automatically interrogates the Area offices. Elaborate error-checking precautions are taken. The second part describes in more detail the communications between regional offices and head office and the tape sorting operation necessary before the data is fed to a UNIVAC computer. The third part is concerned with circuit details of the tape sorter which uses diode matrix convertors operating in conjunction with transistor shift registers; thyratrons are used to drive punch magnets. The final part is concerned with communications between area and regional offices and in particular with operational details of the Autoscan system by which the information is gathered.

G.A.Montgomerie

681.142

1088 A DIGITAL RECORDING AND COMPUTING SYSTEM. M.S.Blynn.
A.I.E.E. Analog and Digital Instrumentation Conference Paper, p.98-112. See Abstr. 3875 (1959).

An automatic data-logging system includes provision for making simple calculations on the quantities involved, for example allowing several to be multiplied together and the square root taken. The calculations are mostly done in analogue form, though storage is digitally on relays. The quantities are first digitised on a relay analogue/digital convertor which has provision, by the use of additional potentiometers, for setting the scale factor, for setting up the zero, and for linearising the reading. Each cycle takes about $\frac{1}{2}$ sec and will give 0.1% accuracy for 100 mV input. Computation is done on similar devices and, like the analogue to digital conversion, is controlled by a pin board programme, each pin board allowing up to 40 events to be controlled.

G.A.Montgomerie

681.142

1089 APPLICATION OF THE N.C.R. 304 DATA PROCESSOR TO THE SYNTHESIS OF A DIGITAL COMPUTER BUILDING BLOCK. G.H.Goldstick and M.Kawahara.
I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 204-17 (1959).

SCAN is a solid-state account number checking device of which the principal component is a building block consisting of a tape wound core/transistor regenerative amplifier. Several of these are associated with a clock generator, also consisting of a tape wound core and a transistor, in a circuit whose function is described in detail with timing diagrams. The design of the circuits was optimized by using an N.C.R. 304 Data Processor. The mathematical models used for the various components are briefly described and the circuit design equations given in detail in two appendices. A block diagram of the computor programme shows the general method adopted, which was to fix various parameters, to derive the clock pulse width, and then to design the clock generator. Pairs of parameters were varied at a time, and the results tabulated to permit rapid choice of the best conditions.

G.A.Montgomerie

681.142 : 621.374.32

1090 SYSTEM SYNTHESIS WITH THE AID OF DIGITAL COMPUTERS. J.B.Dennis, R.F.Nease and R.M.Saunders.
Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 512-15 (1959) = Commun. and Electronics, No. 45 (Nov., 1959).

The conventional procedure for designing systems with many physical parameters is discussed and the translation of this procedure into digital computer operations is considered. Although it is possible to code all of the routine design calculations for a computer, it is impossible to programme the insight of the design engineer. It is shown that the determination of the physical parameters for the optimum design of a system is generally equivalent to the minimization of a function subject to constraints. The application of the method of steepest descent to minimization problems is discussed. A method for extending its use to minimization with constraints is presented.

681.142 : 621.374.32

1091 THE APPLICATION OF DIGITAL COMPUTERS TO ROTATING-MACHINE DESIGN.
G.W.Herzog, O.W.Andersen, J.Scrimgeour and W.S.Chow.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 814-19 (1959) = Pwr Apparatus Syst., No. 44 (Oct., 1959).

A list of programmes in actual use for rotating machine design is presented. The features of one induction motor performance programme are first described in some detail followed by a description of three programmes for synchronous motor design. The combination of these three programmes has many of the features of a complete synthesis programme but with sufficient compromise for practical operation on a medium-sized digital computer.

681.142

1092 APPLICATION OF ROW-BY-ROW MATRIX INVERSION TO POWER SYSTEM PROBLEMS. V.Converti.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 413-16 (1959) = Pwr Apparatus Syst., No. 42 (June, 1959).

Describes the development of a digital computor programme for the inversion of large, 60 by 60 complex 120 by 120 real, matrices. An iterative method is employed and the inverse matrix is built up row by row. This is of advantage in the solution of power system problems when only specified rows may be required.

W.A.Cameron

681.142 : 621.311.153

1093 A SOLID STATE DIGITAL COMPUTING SYSTEM FOR ELECTRICAL LOAD MONITORING.
R.J.Thomas, J.O.Gustafson and G.E.Foster.
A.I.E.E. Analog and Digital Instrumentation Conference Paper, p.88-97. See Abstr. 3875 (1959).

A metering system built up from core/transistor logical elements uses the existing metering pulses from a number of power meters and sums them. The operation is in half hour periods, corresponding to the period over which the supply authority assesses the maximum demand. At the end of the first five minutes the total power flow multiplied by six is printed out; at the end of ten minutes the total of the power flow in the first five minutes is added to five times that in the second five minutes, and printed out. In this way, at the end of each five minute period a predicted value for the end of the half hour is given, and the operator can adjust his load to avoid demand penalty charges.

G.A.Montgomerie

681.142

1094 OPTIMUM MACHINE DESIGN BY DIGITAL COMPUTER. G.L.Godwin.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 478-88 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

A general discussion of the problems involved in the use of computers for optimizing engineering designs is illustrated by specific methods developed for squirrel-cage induction motors. The computer programme is described in outline and the results in an optimum design which will fulfil a set of specified conditions fed into the computer on a set of punched cards. If no design would be satisfactory, the nearest possible solutions are given. The organisational means by which the programme is made available to design engineers unfamiliar with computers is described.

G.A.Montgomerie

681.142

1095 A DIGITAL INSTRUMENTATION SYSTEM FOR USE IN THE TESTING OF JET ENGINES. L.Airey.

Trans Soc. Instrum. Technol., Vol. 11, No. 3, 163-71 (Sept., 1959).

An automatic data-handling system embodying an electronic digital computer is described. Digitizing techniques have been applied to manometers, Bourdon pressure gauges, and high-speed galvanometers; a description of prototype instruments is given.

681.142

1096 WIND TUNNEL DATA HANDLING. E.Patterson.

Electronic Engng, Vol. 32, 30-6 (Jan., 1960).

A survey for the non-specialist of the requirements for data-handling systems for wind tunnels. The difficulties that arise due to limitations of space available in the model for instrumentation and the fundamental properties of the transducer are discussed.

681.142

1097 MECHANICAL TRANSLATION IN THE U.S.S.R. M.Corbé.

Automatisme, Vol. 4, No. 7-8, 278-86 (July-Aug., 1959). In French.

Reviews the historical development of mechanical translation of languages in the U.S.S.R. The total effort is now considerable; the distinctive contribution of various research institutes to the problem is carefully analysed. A.E.I. Research Laboratory

681.142

1098 AUTOMATIC CHARACTER RECOGNITION. D.A.Young.

Electronic Engng, Vol. 32, 2-10 (Jan., 1960).

Following an introductory survey of some of the principal automatic character recognition systems that are currently in either the production or research stage, the fundamental semantic features and limits of character patterns are discussed. It is demonstrated that by an analysis of these limiting features, it is possible to formulate definitions of character patterns that are particularly amenable to translation in terms of discriminatory logic.

681.142

1099 CHARACTER DISPLAYS USING ANALOG TECHNIQUES. S.C.Chao.

Electronics, Vol. 32, No. 43, 116-18 (Oct. 23, 1959).

In this system a c.r.t. beam is positioned by two major deflexion voltages to a point on the screen called the sub-origin. This position is the origin from which the cartesian coordinates of the dots which form the character outline are measured. By means of numerous diode binary switching circuits, voltages are tapped off from a pair of resistor chains for each character, and these form the vernier position of the beam. Each dot is obtained from such a pair of voltages, the beam being blanked during transient motion. The pulsing circuits are controlled from a 300Kc/s clock pulse. A reset pulse switches the system immediately a character is complete to allow a new character to be displayed. Adequate description is given of circuits with illustrations. K.C.Garner

681.142 : 621.317.79

1100 THE USE OF A REPETITIVE DIFFERENTIAL ANALYZER FOR FINDING ROOTS OF POLYNOMIAL EQUATIONS. P.Madich, J.Petrich and N.Parezanovich.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 182-5 (June, 1959).

Describes a procedure for obtaining real and complex roots of algebraic equations with real or complex coefficients by the use of a repetitive differential analyser. The procedure requires only operational amplifiers and ganged linear potentiometers. Differential analysers are very suitable for solving algebraic equations since they permit visual checking of the procedure and make it possible to investigate how the roots of the polynomial are affected by variation of its coefficients. The procedure is not iterative.

681.142

1101 CIRCUITS FOR SOLVING DIFFERENCE EQUATIONS. S.Węgrzyn.

Bull. Acad. Polon. Sci. Ser. Sci. tech., Vol. 7, No. 4, 295-7 (1959).

The basic computing element is a so-called "delayed step circuit" which comprises a motor-driven feedback potentiometer, the wiper potential being subtracted from the input signal to yield an error signal. The magnitude of this error controls the duration of a pulse which commences at regular intervals. The motor is energized in an appropriate sense, for the duration of each pulse, to tend to cancel the error. A second potentiometer ganged to the motor shaft can be used as the output. A relatively higher reference supply is applied to this second potentiometer to obtain an overall voltage gain. If "n" such units are arranged in cascade with each of their outputs returned to a common summing-point, the resulting system solves an nth-order difference equation. Initial conditions are included by having fixed voltages summed in at appropriate junctions. Nonlinearities can also be provided for by devising nonlinear control over the distribution of the pulse steps. Only the principle of the method is discussed with meagre diagrams.

K.C.Garner

681.142

1102 GENERALIZED INTEGRATION ON THE ANALOG COMPUTER. G.A.Bekey.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 210-17 (June, 1959).

One of the major limitations of the electronic analogue computer is its inability of perform directly an integration with respect to a dependent variable. This paper reviews the usual methods of overcoming this limitation, describes the results on an attempt to use Pade time-delay units in generalized integration, and presents the development of a new analogue integrator based on a simple numerical integration formula. The integrator can be instrumented using standard components. Performance is illustrated with several examples.

681.142

1103 THE HANDLING OF NONLINEARITIES WITH THE ANALOGUE COMPUTER. H.Schuchardt.

V.D.I. Z., Vol. 101, No. 28, 1305-12 (Oct. 1, 1959). In German.

Discusses mainly the application of diode networks in conjunction with operational amplifiers to produce discontinuous functions, and linear segment approximations to arbitrary functions. A second section deals with servo-driven tapped potentiometers. Two simple simulations are given as examples, and the circuits discussed are illustrated. K.C.Garner

681.142

1104 LINEAR SYSTEM APPROXIMATION BY DIFFERENTIAL ANALYZER SIMULATION OF ORTHONORMAL APPROXIMATION FUNCTIONS. E.G.Gilbert.

I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 204-9 (June, 1959).

Various analytic procedures have been proposed for minimum integral-square-error approximation of prescribed linear systems; however, they often involve computational difficulties. In the procedure developed, a group of N linear approximating systems with orthonormal impulse responses $\phi_n(t)$ are realized by operational amplifier circuits. When h(–t) forces the systems {h(t) is the impulse response of the prescribed system} it is found that their outputs at t = 0 are a_n, the coefficients in

$$h^*(t) = \sum_{n=1}^{N} a_n \phi_n(t),$$

the approximate impulse response. The following points relative to the approximation procedure are developed: constrained and weighted integral-square-error approximations, derivation and realization of orthonormal functions, physical realization of $h^*(t)$, evaluation of error $h(t)-h^*(t)$, and analysis of computer errors. Several approximation examples are given.

681.142 : 621.372.6

1105 INTERCONNECTIONS AND MEASUREMENTS OF TRANSFER FUNCTIONS ON AN ANALOGUE COMPUTER. W.Schlissler.
Arch. elekt. Übertragung, Vol. 13, No. 10, 405-19 (Oct., 1959). In German.

A clear and comprehensive paper describing the use of electronic analogue computer techniques for the investigation of the behaviour of networks represented by linear transfer functions. The interesting feature is the fundamental approach which relates the pole–zero configuration to the computer set-up. K.C.Garner

681.142

1106 OPTIMIZATION BY RANDOM SEARCH ON THE ANALOG COMPUTER. J.K.Munson and A.I.Rubin.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 200-3 (June, 1959).

One method of searching a system for optimum operating conditions is to evaluate system performance for many randomly chosen combinations of the independent parameters. The use of standard electronic analogue-computer equipment to accomplish such a search of a mathematical model quickly and economically is explained. Gaussian noise sources generate values of the independent parameters and sample-hold circuits hold those values which give the best value of the optimization criterion. An application of the method to a production allocation problem is mentioned.

681.142

1107 A HIGH-SPEED ANALOG–DIGITAL COMPUTER FOR SIMULATION. R.C.Lee and F.B.Cox.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 186-96 (June, 1959).

Describes the principles of operation and logical design of an analogue–digital computer capable of simulating complex physical systems in real time. Information in the machine is represented by an analogue voltage pulse and a digital number. Arithmetic operations are performed in time-shared analogue computing components and conventional digital logical elements. A novel floating-point arithmetic feature is provided to extend the dynamic range of the machine variables. Instructions and constants are stored on a magnetic drum before computation begins. The instructions determine the sequence of computer operations, and both the instructions and constants are arranged so that random access to the drum is not needed. The programming techniques for the computer are described. The inherent simplicity of these techniques should permit engineers directly concerned with simulation to programme their own problems for computer solution.

681.142

1108 DISTRIBUTED PARAMETER VIBRATION WITH STRUCTURAL DAMPING AND NOISE EXCITATION. R.V.Powell.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 197-200 (June, 1959).

A method is described for the electronic analogue computer that will permit the determination of the vibration amplitude responses of a distributed system with structural damping to a random-noise excitation such as might be experienced by a missile structure accelerated by a jet propulsion system. There is general agreement among the investigators in the literature that structural damping is both frequency independent and amplitude dependent. Simulation of the structure by a method of normal modes permits the introduction of a discrete equivalent viscous-damping coefficient for each mode frequency, thereby effecting the frequency-independent characteristic of structural damping.

681.142

1109 A PERTURBATION TECHNIQUE FOR ANALOG COMPUTERS. L.Bush and P.Orlando.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 218-21 (June, 1959).

A study of the motion of a fin-stabilized rocket was undertaken to determine the effect of perturbing forces on the trajectory. The mechanization of a complete problem for an analogue computer to include small disturbing forces would result in trajectories which are essentially indistinguishable from the "nominal" or "unperturbed" case because of analogue computer accuracy limitations. Instead, the equations of motion for the "nominal" case and the "perturbed" case, derived by first order ballistic perturbation theory, were solved simultaneously with the nominal solution providing inputs to the perturbed solution. The analogue computer solution provided both the nominal trajectory and perturbations from this trajectory. To illustrate the method, the technique is applied to the two-dimensional motion of a rocket in the vertical plane and includes perturbations due to uncertainities in winds, atmospheric density, thrust malalignments, and stability margin.

681.142

1110 A FOUR-QUADRANT MULTIPLIER USING TRIANGULAR WAVES, DIODES, RESISTORS, AND OPERATIONAL AMPLIFIERS. P.E.Pfeiffer.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 2, 222-7 (June, 1959).

A simple scheme of switching triangular waves and measuring the average current through resistors into a low impedance summing point makes possible four-quadrant multiplication with four diodes, precisely adjusted resistors, and a means of measuring the current. A practical circuit utilizes one operational amplifier to obtain $-(X + Y)/2$ and a second such unit to measure the summing point current. Addition of four auxiliary diodes reduces circuit interactions and makes less stringent requirements on the diodes. A simple operational adjustment procedure is described. A simple means for obtaining the precise resistance balance is also outlined. Calibration does not depend upon triangular wave frequency or symmetry. The amplifiers are not required to handle the triangular wave frequencies.

681.142

1111 DESIGN CONSIDERATIONS FOR A CELESTIAL NAVIGATION TRAINER. M.D.Bennett and N.B.Mickelson.
I.R.E. Trans Military Electronics, Vol.MIL-3, No.3, 69-75 (July, 1959).

Gives a short history of the need for navigation training and tells what a navigator should know. It also tells how navigators were trained in the middle ages and of training devices used as well as explaining the requirements of the modern celestial navigation trainer and how the 1A19 meets these requirements. It explains, in general engineering terms, the techniques used for simulation of motion and references and changes in references required for navigating.

681.142

1112 AN INTEGRATED SPACE-FLIGHT SIMULATOR. M.Ackerman.
I.R.E. Trans Military Electronics, Vol.MIL-3, No.3, 92-8 (July, 1959).

The role of the flight simulator in the space vehicle programme is presented. Application of a simulator as an engineering and development aid is discussed. A simulator for training the space crew is anticipated and therefore is mentioned in passing. A brief review is made of contemporary thinking regarding anticipated physiological and psychological effects on the future crew. A simulator is then defined which will integrate these effects, thus providing a complete environment for experimentation. Early phasing of the integrated simulator with the space vehicle is suggested as a better foundation for design of the space cabin or capsule than sole dependence on feedback from early flights.

681.142 : 621.396.946

1113 THIRTY-TWO AIRCRAFT RADAR TRACK SIMULATOR. L.Packer, M.Raphael and H.Saks.
I.R.E. Trans Military Electronics, Vol. MIL-3, No. 3, 114-22 (July, 1959).

Describes a radar track simulator which generates the track of thirty-two aircraft in x, y, and h coordinates accurate to one-hundreth of a mile and produces video accurate to one-hundreth of a mile in range, one milliradian in azimuth and two milliradians in elevation. The output video signals are modified by the radar beam pattern, aircraft scintillation noise, radar receiver noise, fading of video signal with range, and blip-scan effects to produce a realistic display.

681.142 : 621.389

1114 RESPIRATORY CONTROL OF HEART RATE: LAWS DERIVED FROM ANALOG COMPUTER SIMULATION. M.Clynes.
I.R.E. Nat. Convention Record, Vol. 7, Pt 9, 22-41 (1959).

A mathematical model of the "dynamics" of the heart, derived from observations on an analogue computer is described. The true

heart beat is compared with the "computer heart beat" and is shown to accord closely over a wide variety of modes of breathing. The effects of age as well as of drugs are expressible as parameters in the equations, and the operative factor influencing heart beat is shown to be the "stretch" of the chest, not haemodynamic conditions of the blood system. F.T.Farmer

681.142

1115 ANALOG COMPUTER AIDS HEART AILMENT DIAGNOSIS. R.L.Skinner and D.K.Gehmlich.
Electronics, Vol. 32, No. 40, 56-9 (Oct. 2, 1959).

The concentration of dye injected at the entry to the heart is detected on the exit side. If there were no recirculation the integral of the curve against time would give cardiac output. The computer "senses" the initial part of this curve and matches it automatically to a generated exponential of the same time-constant. After a given time a switch changes over the integration from the natural to the artificial curve so that a reading is obtained of the integral to zero concentration. F.T.Farmer

681.142 : 621.374.32

ON THE ANALYSIS OF POTENTIAL–IMPULSE SYSTEMS BY MEANS OF SPECIAL TRANSFER OPERATORS. See Abstr. 827

681.142

1116 THE ELECTRONIC SIMULATION OF THE LOAD APPLIED TO AN INSECT MUSCLE. K.E.Machin.
Electronic Engng, Vol. 31, 740-4 (Dec., 1959).

Certain insect muscles when suitably loaded contract rhythmically; the oscillation is largely controlled by the mechanical parameters of the load. An apparatus has been developed in which the mass, viscosity and stiffness of the load are simulated electronically, and can therefore readily be varied. The relation between force and length for an oscillating muscle can be displayed on a cathode-ray tube, while the frequency of oscillation and power output are presented on meters. The apparatus can also be used for direct measurement of the mechanical impedance of a muscle as a function of frequency.

MECHANICAL AND CIVIL ENGINEERING TECHNOLOGY

MATERIALS . TESTING

620.11

1117 GROUP TESTING TO ELIMINATE EFFICIENTLY ALL DEFECTIVES IN A BINOMIAL SAMPLE.
M.Sobel and P.A.Groll.
Bell Syst. tech. J., Vol. 38, No. 5, 1179-252 (Sept., 1959).

In group-testing, a set of x units is taken from a total starting set of N units, and the x units ($1 \leq x \leq N$) are tested simultaneously as a group with one of two possible outcomes: either all x units are good or at least one defective unit is present (it is not known how many or which ones). Under this type of testing, the problem is to find the best integer x for the first test and to find a rule for choosing the best subsequent test-groups (which may depend on results already observed), in order to minimize the expected total number of group-tests required to classify each of the N units as good or defective. It is assumed that the N units can be treated like independent binomial chance variables with a common, known probability p of any one being defective; the case of unknown p and several generalizations of the problem are also considered.

620.11

1118 INSPECTION OF LARGE BOILERS.
G.Barnard.
Elect. Rev., Vol. 166, No. 1, 8-11 (Jan. 1, 1960).

Describes the examinations that take place during construction at the manufacturers' works and on site, those carried out during normal maintenance and those required for compliance with statutory regulations. Although the regular testing of pressure parts is governed by statute, no stipulation is made for the whole plant unit, and an additional annual inspection is suggested.

620.172.222 : 531.768

1119 HIGH-FREQUENCY STRAIN GAUGE AND ACCELEROMETER CALIBRATION.
J.S.Nisbet, J.N.Brennan and H.I.Tarpley.
J.Acoust. Soc. Amer., Vol. 32, No. 1, 71-5 (Jan., 1960).

For earlier work see Abstr. 5671A (1958); J. Acoust. Soc. Amer., Vol. 30, No. 1, 41-6 (Jan., 1958). A method and apparatus are described for calibrating bonded wire resistance strain gauges in the frequency range from 2 to 20 kc/s. The gauges are mounted on an electromagnetically excited longitudinally resonant bar whose amplitude of vibration is measured by an interferometer. Results are given for one type of gauge. Factors affecting the frequency sensitivity relationship of bonded wire strain gauges are discussed. Application for calibration of accelerometers is discussed.

620.178.311.5

1120 AUTOMATIC ELECTRONIC CONTROL OF VIBRATION TESTS. R.A.Schomburg and F.J.Trebby.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 595-8 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

The fatigue testing of electrical conductors by electromechanical vibration systems at controlled frequencies and amplitudes is complicated by changes of length, tension, ambient temperature, etc., all of which change the resonant frequency. A driving system consisting of oscillator, amplifier and driver will go off resonance when these changes occur. Automatic frequency control is achieved by deriving the driving signal from a vibration pick-up placed close to the vibrating wire. The wire then forms part of the oscillatory system and is automatically maintained in vibration. A description is also given of a feedback system for maintaining constant amplitude of vibration. A.C.Whiffin

620.179

1121 RECENT PROGRESS IN THE INDUSTRIAL APPLICATION OF ULTRASONICS. J.Palme.
Tech. mod., Vol. 51, No. 5, 237-43 (May); No. 9, 471-6 (Sept., 1959). In French.

Descriptions are given of ultrasonic generators including electromagnetic transducers and sirens. Ultrasonic flaw detectors are described and an ultrasonic microscope, both of which use power at a low level. Other low power apparatus described includes delay lines, flowmeters and level detectors. High power ultrasound from siren generators is used to dry or clean gases, while a number of sirens placed around a site may be used to disperse fog. High-power electronically fed, transducers are used for cleaning metallic pieces and for controlling grain size in metallurgy. Ultrasonic vibrations are used to keep ship's hulls free from parasites and to age wines. A.C.Whiffin

620.179.16

1122 CAVITATION EROSION OF SONIC RADIATING SURFACES. H.F.Osterman.
I.R.E. Nat. Convention Record, Vol.7, Pt 6, 213-18 (1959).

Preliminary results of a continuing programme to improve the design of transducers for large-scale cleaning and processing applications are presented. The criterion for suitable materials is taken as the transducer weight loss per hour. This weight is mainly dependent on the radiating surface, liquid used and operating temperature. For example, a brass transducer operating at 20 kc/s in water suffers a peak weight loss at 147°F. Hardness is shown to be a good indicator of erosion resistance. The present use of stainless steel for transducers is upheld both from resistance to chemical attack and erosion. Small changes in composition and processing of transducers are found to have large effects on efficiency, however. The best material so far found is a 12% Cr–0.16% Ni (tempered) stainless steel with a Brinell hardness of 401. A.P.C.Thiele

LIST OF JOURNALS

The following list supplements the List of Journals to be published with the Index to Volume 62 (1959). Reprints of the List of Journals will be obtainable from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.
The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Math. Comput.

Mathematics of Computation (Formerly: Mathematical Tables and Other Aids to Computation [Math. Tables Aids Comput.])
Publishers: The National Academy of Sciences—National Research Council.
Subscription address: The Printing and Publishing Office, The National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D.C.

Math. Z.

Mathematische Zeitschrift
Springer Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf.

CHANGE OF TITLE

Math. Tables Aids Comput.

Mathematical Tables and Other Aids to Computation.
Title changed to: Mathematics of Computation [Math. Comput.] with issue dated January, 1960.

ERRATA

Abstr. 6310 (1959) line 2: for "O.Bendikt" read "O.Benedikt".
Abstr. 7020 (1959) line 4: for "Pt 5" read "Pt 6".
Abstr. 7021 (1959) line 4: for "Pt 5" read "Pt 6".
Abstr. 7514 (1959) line 4: for "Pt 5" read "Pt 6".

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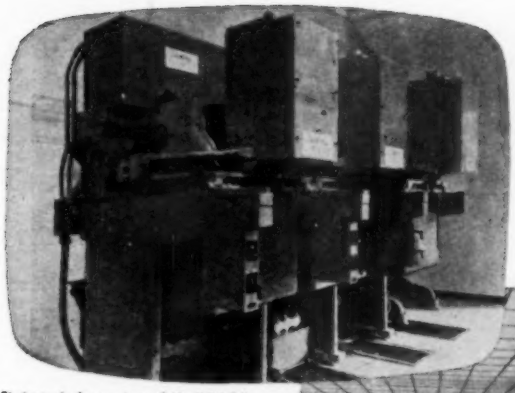

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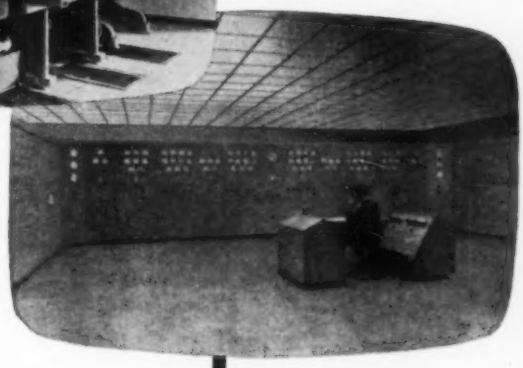

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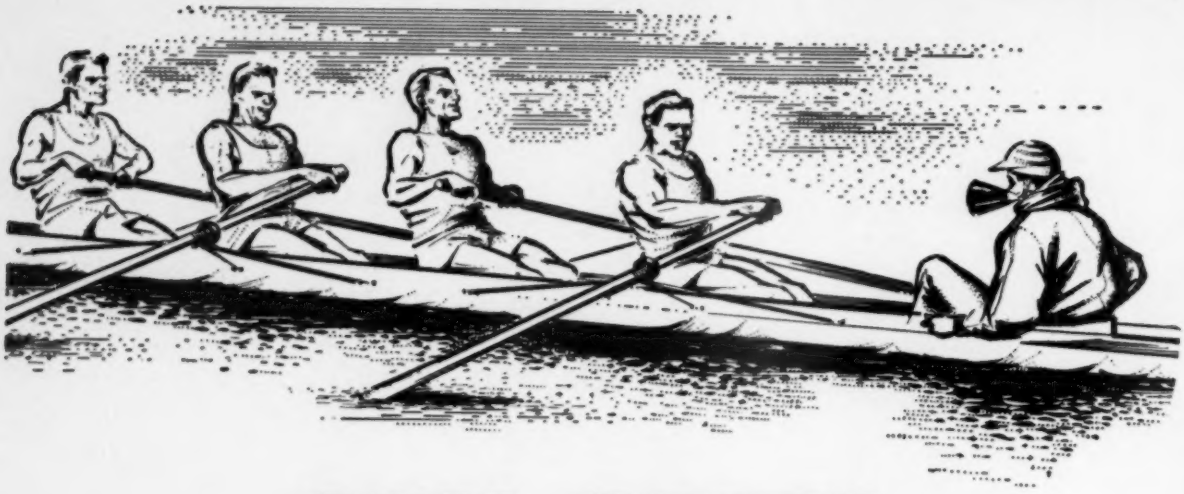

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